Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum in Georgia

by

Brandon Lee Ray

A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
May 1, 2021

Keywords: Agriculture Education, Forestry/Natural Resources, Needs Assessment, High School

Copyright 2021 by Brandon Lee Ray

Approved by

Christopher Clemons, Chair, Assistant Professor of Curriculum and Teaching
James Lindner, Professor of Curriculum and Teaching
Becky Barlow, Professor and Extension Specialist
Jason McKibben, Assistant Professor of Curriculum and Teaching
Nick Fuhrman, Professor, Agricultural Leadership, Education, and Communication
Adam Maggard, Assistant Professor and Extension Specialist

Abstract

There are fewer forestry/natural resources pathway classes being taught in Georgia high schools than any of the other main areas (Georgia Agriculture Education, 2019). Georgia high school agriculture pathways are a series of three interrelated courses designed at giving high school students specific skills and expertise in a designated area. The purpose of this study was to determine teacher perception of forestry/natural resources curriculum in an effort to investigate internal barriers that teachers may be experiencing when implementing those concepts. The participants of this study were high school agriculture teachers across the state of Georgia (N = 358) that represent various demographical regions, economies, and socioeconomic status. This descriptive and correlational study utilized a quantitative non-experimental survey research design. All Georgia agricultural education teachers with more than one year of experience were surveyed and a total of 173 (n = 173) responses were analyzed. The findings of the study yielded descriptive data that reveal particular weaknesses in the importance and competence of forestry/natural resources curriculum. There were a significant number of teachers that did not teach a forestry/natural resource pathway. Teacher importance and competence of forestry/natural resources concepts was analyzed and ranked. The data further shows the discrepancy of perceived teacher importance and perceived teacher competence through Mean Weighted Discrepancy Scores (*MWDS)*. *MWDS* were used to rank forestry/natural resources concepts in an effort to identify training needs of teachers within Georgia. Teachers with fewer years of experience had the greatest need for training in Forestry/Natural Resources concepts. Teachers with no personal experiences in forestry, natural resources, and/or wildlife management also had a significant need for training within those concepts. The findings within this study indicated a number of concepts within forestry/natural resources which could be

addressed through class opportunities at respective universities. It was recommended that universities and state staff find different avenues to market the core subjects within agriculture education in order to draw potential students into the profession. It was also recommended that partnerships to industry professionals are vital in order to build knowledge in the area of forestry and natural resources. Teachers should seek to bring those individuals into their classroom to promote careers within forestry/natural resources.

Acknowledgments

I am truly blessed to have had the opportunity to pursue a doctoral degree at the University of Auburn. Teaching and environmental education have always been a passion of mine. I thoroughly enjoyed the opportunity to research the history, importance, and competence levels of Georgia agriculture educators in relation to forestry and natural resources curriculum, but I could not have done this without the help of several individuals.

I am extremely fortunate in the fact that I got to marry my best friend and the love of my life, Anna Ray. She never complained about having to listen to me talk about my experiences or research throughout the process. Her support for me never wavered, and she was constantly pushing me farther than I thought I was capable of. It has been truly amazing having her by my side through our many adventures. Thank you to my wife Anna for always being my cheering section and making our kids my number one fans.

My graduate committee and instructors during my graduate career have been instrumental in my development and success. I would like to thank Dr. Chris Clemons for serving as my advisor and committee chair. Thank you for your words of advice and encouragement throughout the process and also for putting up with my many emails. Thank you to Dr. Nick Fuhrman who always amazes me with your contagious energy and enthusiasm. I was blessed to have you as a professor during my Master's, and thank you for being a part of my graduate committee at Auburn. Dr. Jason McKibbon, despite his busy schedule, always found time to help me with my statistical analysis and insight on which direction I should run my research. Thank you, Dr. James Lindner, for breaking me into the Ph.D. program at Auburn and answering my emails. Dr. Becky Barlow graciously agreed to be a part of my committee and provided insight on why the results are important and how we can use those results to affect

positive change for forestry/natural resources education. Thanks to Dr. Adam Maggard for making time to provide valuable feedback regarding my research and findings.

I would like to thank my family for being an amazing source of encouragement. I am very lucky to have the best mother, father, and sister a man could have. At an early age my father instilled in me the value of a good education by reminding me to "get a good education so you don't have to do what I do." While working at the local papermill was challenging and took up late hours, he was still able to instill the importance of hard work and education. My mother ingrained many qualities in me as well. Through her, I learned that often times organization is the key to success, to be patient, make good grades, and the value of a good education. She is the most selfless woman I know. Thank you to my mother for always taking time to read and offer suggestions for my papers, including this one! My sister, Beth, has been a source of support for me, and always offered encouragement when I needed it the most. She is an amazing first-grade teacher which is a special calling. I have always enjoyed our talks about education and the challenges we both face despite the different age levels we teach.

I was also blessed to have in laws that were always supportive throughout this process. My mother-in-law, Jeanie, is a true image of strength and is a constant reminder of the importance of rising above your circumstances. All of my grandparents passed away at a young age, but I was fortunate to marry into a family that had three grandparents. Mrs. Beth Plummer was one of the driving forces for my decision to pursue a doctoral degree, and I can't thank her enough for that opportunity. Thanks to BB and Pops for your love and support!

Most importantly, I would like to thank God for this opportunity. Revelation 3:8 states "I know your deeds. I have placed before you an open door that no one can shut. I know that you have little strength, yet you have kept my word and not denied my name." I am truly blessed to

have been afforded the opportunities I have been given and hope that anyone reading this knows that there is a God in heaven and how much he loves each of you. God Bless.

Table of Contents

List of Tables

CHAPTER 1
INTRODUCTION

Selecting an agriculture pathway has become an important factor within the success of high school agriculture education programs. Georgia high school agriculture pathways are a series of three interrelated courses designed at giving high school students specific skills and expertise in a designated area. As the curriculum needs and delivery methods evolve within school based agriculture education (SBAE), so must the lessons that are taught within the classroom (Clemons et al., 2018). Agricultural educators must be able grasp the specific content areas that they are required to teach. Wilent (2011) notes that there was a lack of information on the types of forestry information being presented. Smith (2011) describes that children should learn about forests in public and private schools and poses the question, "Are our children really learning enough about forest resources to ask the right questions and make informed decisions about these resources when they become decision-makers in the future?" (p. 19).

In 2018, there were 453 agricultural education instructors in Georgia with approximately 341 of those being high school instructors (Georgia Agricultural Education, 2019). With the need for a more skilled labor force in forestry, a greater need is placed on our high school instructors to be knowledgeable and emphasize the importance of forestry/natural resources education. Forestry/natural resources pathway classes comprise the lowest group of the major pathway areas (agriculture mechanics, animal science, horticulture, and forestry/natural resources). Potential disadvantages may be present when considering forestry/natural resources curriculum. Factors such as lack of knowledge, difficulty of implementation, and lack of interest make it difficult to find qualified forestry/natural resource instructors. Bowyer (2000) cites this as the reason that many students hold misconceptions about the forestry and natural resources. Wellman (1987)

reported that 31% of college-bound high school seniors knew nothing about forestry careers and only 1% considered themselves to be “well-informed” about forestry.

Shumacher et al. (2012) believes that environmental and natural resources should be very evident in the curriculum. Wilson et al. (2002) noted the importance of teaching natural resources by stating the need for this subject to be integrated into the agriscience curriculum. The 2019 Georgia Agricultural Education Report indicated that only 14% of all agriculture education students were enrolled in a class encompassed in the forestry pathway (forest science, wildlife management, and natural resources management). Pathway percentages in other areas include horticulture (23%), livestock (23%), agriculture mechanics (22%), and other pathway areas such as agribusiness management/veterinary science/agriscience (12%). These numbers, coupled with the importance of the Georgia forestry industry, lead one to contemplate why forestry/natural resources concepts are not being taught more in Georgia schools.

Those working in the forestry and natural resources field conserve and manage our forests and natural resources. The value of this industry in Georgia can be seen from the very beginning of the colony’s establishment. Citing from the 1870 census, the Georgia Forestry Commission (2019) indicated forestry as being a major enterprise for the Georgia economy with a value of $2.4 to $4.0 million. By 1900 Georgia was ranked first in total lumber production and second in the number of sawmills across the nation. Over the course of the 1900s, the value of timber and the forestry industry expanded and the need for conservation practices placed a need for education.

With the increase in production there was a need for a more skilled and educated labor force. This need for forestry education led to the formation of the Georgia Warnell School of Forestry and Natural Resources in 1906 and the Georgia Forestry Association in 1907 (Izlar,

2006). There was much legislation throughout the 1900s that helped guide forestry practices and education, but one thing remained constant, forestry was a major enterprise and economic driver within the state. Today the forest industry is the second largest industry in Georgia providing 118,423 jobs and injecting $27.2 billion into the state's economy (Georgia Forestry Commission, 2019). As the forestry industry grew there was a need for a skilled labor force.

As a result of the need for a skilled labor force, the need for education of forestry and natural resource concepts has grown. Career and technical education (CTE), including agricultural education, focuses heavily on career exploration as well as career and college readiness in order to help students better understand the skill, knowledge, and education expectations of specific careers (DeLuca et al., 2006). In a 2017 study, Lambert found that there was a change in the composition of the workforce in the agriculture, forestry, fishing, and hunting sector. There were fewer hours given to workers with less than a high school education and more hours were supplied by workers with some college, college degrees, or study beyond the bachelor's degree. There were substantial reductions in the total number of annual hours worked by people having less than a high school diploma from 1947 to 2010. There was also a drop of 94% in the number of hours supplied to the sector by these workers and also a 28% reduction in hours supplied by people having a high school diploma, mostly occurring from 1980 onwards (Lambert, 2017). There are many forestry/natural resource-related jobs that require some type of college education. Some examples of these include a certified forester, wildlife biologist, aquaculture manager, fish and game wardens, soil/plant scientist, and forestry teachers. This creates a need for forestry/natural resources concepts and careers to be taught more in our high schools.

Statement of the Problem

An SBAE teacher has to deal with a variety of different barriers that can greatly affect the nature in which the students learn (Johnson, 2007). Jabbour and Pellissier (2019) reported that certain barriers to teaching included a lack of content specific teaching materials, a lack of knowledge or expertise on a specific topic and a lack of time or timing. SBAE teachers in particular must be well-prepared to provide students with the technical and personal skills and qualities needed to obtain employment and establish themselves in a career (Hughes & Barrick, 1993).

Unique and engaging pedagogical approaches are crucial for supporting learning opportunities effective to meet the needs of today's learners (McKendree et al., 2019). The learners of today must be motivated to succeed within a more global, technology-driven, team-based, and complex world (Cohen, 2011). Sharik and Frisk (2011) studied the factors that led to a steady decline in enrollments in undergraduate forestry programs beginning in the mid-1990s. They concluded that students were attracted to majoring in forestry and subsequently pursuing a career in this field by a love of nature or the outdoors (Sharik and Frisk, 2011). Students were hesitant about pursuing a major/career in forestry because of factors such as “low wages, lack of jobs, and a negative public image of forestry” (p. 162). One of the weaknesses in current agriculture and natural resource education programs is a lack of instruction in communicating technical information to others (Copenheaver et al., 2004). This gap is further widened when studying the relationship between what curriculum is being taught in high school classrooms and one of the state’s top agriculture industries: forestry.

Purpose of the Study

The purpose of this study is to determine teacher perception of forestry and natural resources curriculum in an effort to investigate potential internal barriers SBAE instructors may be experiencing when attempting to implement that curriculum. The need to investigate this topic is aligned with priorities of both the Georgia Vocational Agriculture Teachers' Association (GVATA) and the American Association for Agriculture Education (AAAE). The GVATA (2019) states the priority to identify the needs of new teachers (1-5 years) and mid-career teachers (7-15 years) in the 2019 Tactical Plan (p. 18). The GVATA Tactical Planning committee (2019) also indicates the need for more training within their professional development committee by stating the need to "evaluate professional development workshops needed for members and make recommendations considering industry advised changes in technical information (p. 3)." The AAAE also states the need for discovering "what methods, models, and practices are most effective in diffusing innovations (Roberts et al., 2016, p.6)." Within research priority five the AAAE also poses the question "what evaluation methods, models, and practices are effective in determining the impacts of educational programs in agriculture and natural resources (Roberts et al., 2016, p. 6)."

Objectives of the Study

The following is an overview of the research objectives within this study:

1. Identify and describe the personal characteristics of high school agricultural education teachers in Georgia.
2. Describe the perceived level of instructor importance of the forestry and natural resources curriculum for high school agricultural education teachers.

3. Describe the perceived level of instructor competence of forestry/natural resources curriculum for high school agricultural education teachers.

These research objectives will provide the data necessary to gain a better understanding of perceived barriers agriculture instructors experience when implementing forestry and natural resources curriculum.

Theoretical Frameworks

The theoretical framework for this study was be grounded in Borich's (1980) Needs Assessment Model.

Needs Assessment Model

Institutions that train individuals are continually looking for ways to improve their training programs. Borich (1980) developed a method of needs assessment designed to improve the training programs of institutions for professional development. The Borich Needs Assessment measures the discrepancy between the goals of a program or organization and performance of participants of that program or organization. This is achieved through utilizing Mean Weighted Discrepancy Scores (*MWDS*) to identify the need priorities of participants of a particular program (Ashraf et al., 2020). The Borich Needs Assessment measures the discrepancy between the goals of a program or organization and the performance of participants of that program or organization. The concept of evaluation implied in the model is determining the congruence between what should be and what is between what the teacher should be able to do and what the teacher can do (Borich, 1980). Borich's Needs Assessment Model includes the following steps:

1. Both desired and existing (Importance or Ability) competencies should be listed in the questionnaire.

2. Circulate the questionnaire among the participants/respondents.
3. Data tabulation on MS Excel.
4. Calculate the discrepancy score by subtracting Ability from Importance.
5. Calculate the WDS by multiplying the overall mean of Importance with the discrepancy score.
6. Find the mean of WDS to determine the *MWDS.*
7. Rank the competencies by employing the *MWDS* in numerical order to identify the prioritized training needs.

Assumptions

When assessing the assumptions of this study it is important to understand that without them the research problem itself could not even exist (Leedy & Ormand, 2010). The assumptions of this study are:

1. This sample will utilize a questionnaire that will provide responses that are an accurate representation of the entire sample.
2. All participants will be provided clear and specific instructions by the researcher.
3. All teachers completing the questionnaire have taught high school agriculture for at least one year.

Limitations

There are specific limitations that can enable the ability to provide representative findings from the entire population. The following limitations have the potential to confine this study as it relates to the research objectives.

1. There could be possible unknown conditions or perceptions that exist at the schools in which the participants are employed.
2. Another potential limitation of this study included non-response error negatively affecting the internal validity of the questionnaire. This limitation was addressed by providing a clear justification for the study and follow-up correspondence used as necessary to encourage all members of the sample to participate.
3. Participants within this study are Georgia agriculture educators and teach according to the Georgia Performance Standards. This limits the findings of this study to teachers within the state of Georgia.

Definition of Terms

1. *Agricultural Education:* secondary agricultural education programs that instruct individuals in the food, fiber, and natural resource industry (Phipps et al, 2008)
2. *American Association for Agricultural Education (AAAE):* a professional society for faculty and graduate students who have specific research interest in agricultural communication, education, extension, and leadership. (Roberts, Harder, & Brashears, 2016).
3. *American Association for Agricultural Education National Research Agenda:* the AAAE establishes research priorities every 5 years regarding contemporary issues in agricultural education. These priorities guide research strategies and practices for the given years outlined by the agenda (Roberts, Harder, & Brashears, 2016).
4. *Channel:* the means by which a message gets from the source to the receiver (Rogers, 2003).

5. *Communication:* a process in which participants create and share information with one another to reach a mutual understanding (Rogers, 2003).
6. *Curriculum*: A set of experiences, courses of study, and activities which are outlined by a specific educational program that students must engage in order to accomplish the desired educational program objectives (Von Crowder, 1997).
7. *Diffusion:* the process by which innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003).
8. *Forest Science*: the science of managing forested land, along with associated waters and wasteland, primarily for harvesting timber, but also for conservation and recreation purposes (Burton, 2012).
9. *Forestry:* the profession embracing the science, art, and practice of creating, managing, using, and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs, and values (SAF, n.d.).
10. *Georgia Performance Standards*: a set of learning standards that must be covered within each content area. These standards are a concise and direct roadmap, which should be utilized to develop course instruction and facilitate teaching strategies (Woods, 2016).
11. *High School Agricultural Education*: the systematic instruction in agriculture and natural resources within grades 9-12 for the purpose of preparing people for entry or advancement in agricultural occupations or professions, job creation and entrepreneurship, and agricultural literacy (Phipps et al., 2008).
12. *Innovation*: an idea, practice, or object perceived as new by an individual or other unit of adoption (Rogers, 2003).

13. *Natural Resources*: items such as coal, water, arable land, oil and minerals that are found in nature and of use to human kind (Deal, 2016).
14. *Nonresponse Error*: the result of people who respond to a survey being different from samples individuals who did not respond, in a way relevant to the study (Dillman, Smyth, & Christian, 2014)
15. *Over Sampling:* the variance above the target sample above that aids in correcting for non-response (Fink, 1995).
16. *Social System:* a set of interrelated units engaged in joint problem solving to accomplish a common goal (Rogers, 2003).
17. *Source*: an individual or an institution that originates a message (Rogers, 2003).
18. *Teaching Barrier*: anything that stands in the way of a teacher being able to teach effectively
19. *Vocational Education*: educational experience that provides students with experiential and work-related experiences. Agricultural education was commonly referred to as vocational education prior to the 1980s (Phipps, 2008).
20. *Wildlife Management*: the care of wildlife and its environment in such a manner as to ensure the continuation of the species (Deal, 2016).

Chapter Summary

Chapter 1 provided justification for the need and purpose to discover perceived barriers to Georgia agriculture teachers when implementing forestry/natural resources curriculum. Forestry and natural resources education are very important in providing agricultural literacy in today's agriculture education classrooms. Agricultural literacy is essential in the recruitment of teachers who can facilitate opportunities for students to learn concepts and problem-solving

skills within one of Georgia's top agricultural industries. The high school forestry and natural resources curriculum provides students with experiences in many different areas of the industry through the experiential learning method. These experiences help students understand the value of our natural resources and importance of forest conservation. Implementing curriculum regarding these topics is essential in teaching our students not only the value of the industry, but also makes them aware of possible careers in agriculture. However, the needs of today's students are constantly changing and thus the challenges to the teachers need to be addressed. This study focused on the barriers to implementing forestry/natural resources curriculum, as perceived by the teachers, to determine areas of weakness and possible professional development needs.

Selecting an agriculture pathway has become an important factor within the success of high school agriculture education curriculum. Implementing forestry and natural resources curriculum aids in closing the agriculture literacy gap within the United States. This study was also designed to investigate the problem of a low number of forestry/natural resource programs being taught across the state of Georgia. This is critical in order to address the needs of the agriculture student, the needs for a skilled labor force within forestry/natural resources, and overcoming barriers that forestry/natural resources teachers experience upon the implementation of this curriculum. The following chapter provides a review of the relevant literature, as well as the theoretical foundations that served as a guide for this study.

CHAPTER II
REVIEW OF LITERATURE

Introduction

The purpose of this study was to describe teacher perception of internal barriers that Georgia high school agriculture teachers may experience when implementing forestry/natural resources curriculum. Due to new and ever-changing environmental challenges faced by the United States and the world, the need for well-trained environmental and natural resources individuals is increasingly critical (Sharik & Frisk, 2011). The following literature presents an in-depth review of the public research and history as it relates to this research study. This chapter was divided into the following sections: (1) School Based Agriculture Education (SBAE); (2) Agricultural Education Pathways; (3) History of Forestry/Natural Resources Education: (4) Barriers to Curriculum Implementation; (5) Theoretical Frameworks; (6) Summary.

Background

Schools wishing to implement high school agriculture courses today have the option to choose from 45 different courses ranging from agricultural mechanics to small animal care (Georgia Agricultural Education Annual Report, 2019). Agriculture was the cornerstone of development and subsistence for farmers throughout the early years of the United States. Families needed food on the table, but also bartered crops they had produced for other needed goods. This garnered the need for better education within agricultural subjects.

Agricultural Education

SBAE has greatly evolved since its introduction into formal education. Agricultural education is defined as: “The systematic instruction in agriculture and natural resources at the elementary, middle, secondary, postsecondary, or adult levels for the purpose of preparing

people for entry or advancement in agricultural occupations and professions, job creation and entrepreneurship, and agricultural literacy" (Phipps et al., 2008, p. 3).

SBAE was a fairly new concept in formal education during the late 1800s. Typically elementary schools were the only areas that agriculture education was seen in the classroom. With the passage of the Morrill Acts in the late 1800s, there began a big push for agricultural education that would lay the foundation for further legislation (Talbert, 2014). These acts helped in some sense to appease the growing concern for developing a vocational workforce. The philosophy of pragmatism or "knowing by doing" began to take hold and brought about the base concept of vocational education (Magee, 2001). In the early 1900s, there was a growing concern for vocational education as there were many apprentices not getting the same quality education from the tradesperson as others. In 1906, SBAE was being offered in less than 100 secondary schools across the United States (Robinson & Jenks, 1913). At this point in the early 1900s, SBAE began to grow at a rapid rate with a specific focus upon secondary programs (Hillison, 1986). Despite the growth in SBAE, there was much criticism about the early educational methods. People argued that the current level of SBAE was too basic and did not provide students with a fundamental understanding of the industry necessary for future growth and development (Davenport, 1908).

With the passing of the Smith-Lever Act and eventually the Smith-Hughes Act, America began to see more effort and funds put into training the youth in vocational skill areas (Talbert, 2014). The growth of SBAE continued to rise quickly, and by the end of the 1914-1915 school year, SBAE programs were being offered in 4,390 secondary schools, which provided quality instruction to 85,573 students across the United States (Camp, 1987). While things such as the Supervised Agricultural Experience (SAE) were put only into practice by a few such as Rufus

Stimson in the early 1900s, America began to see more and more emphasis being placed on SBAE through the formation of student organizations such as the Future Farmers of America (FFA) and New Farmers of America (NFA) in the mid-1900s. Referred to at this time as vocational education, SBAE incorporated classroom instruction, hands-on experiential learning, work-related experience, and application through youth organizations (Friedel, 2011). These educational programs were instituted upon what now serves as a component of the FFA motto: "Learning to do and doing to learn" (National FFA, 2020).

The passing of the Smith-Hughes Act in 1917 paved the way for federal support for agriculture education. This act established federal funding and support for SBAE which provided the resources necessary to grow and develop agriculture education programs across the county (Camp, 1987). The act also outlined three guidelines that school systems must follow in order to receive federal support:

1. Students were to be properly and adequately prepared for needed employment.
2. Students were required to be in secondary school and not already enrolled in college courses.
3. Programs were to be designed for students who were over 14 years old and who were currently working or planning to work on or in a particular farming enterprise (Phipps et al., 2008).

The Smith-Hughes Act spurred many other pieces of legislation that would help guide SBAE over the course of the next 100 years. With the passing of the Vocational Act of 1963 and the Perkins Acts, America began seeing more funding put into agriculture education that would greatly increase the student possibilities for vocational education. SBAE saw its first youth leadership organization come to fruition with the founding of the Future Farmers of America

(FFA) in 1928 and subsequently the New Farmers of America (NFA) in 1950. With the development of these agricultural youth organizations, a new generation of students was born that had a passion for learning about agriculture and applying their knowledge and skills to local farms and the workforce (Malpiedi, 1987).

Over the last several decades there has been federal legislation that continues to support SBAE. In 1984 there were various pieces of the Perkins Legislation that impacted vocational education throughout the United States. The goal of the Perkins Legislation has remained constant over the years, to improve the quality of vocational education at both the secondary and post-secondary levels (Shoreline, 2003). The first part of this legislation was the Carl D. Perkins Vocational Education Act of 1984 which focused on improving labor force skill and job preparedness while providing equal opportunities for adults that are enrolled in vocational education programs (Phipps, 2008). This act contained nine goals that helped connect different vocational student organizations to the instructional program. Various pieces of new Perkins legislation were introduced from 1984 to 2006 that would continue to bolster SBAE programs. This legislation is aimed at helping today's students gain the academic and technical skills and knowledge necessary for high school. The major purposes of these acts were to more fully develop academic and career/technical skills of secondary and postsecondary education students who enroll in career/technical education programs (SREB, 2007). SBAE was not just limited to those rural areas of America. In recent years most SBAE programs were offered in rural settings, but recent initiatives and support have helped provide students with these educational opportunities in urban settings as well (Mercier, 2015).

SBAE has grown substantially over the years and the National FFA Organization estimates that over 800,000 students participate in formal agricultural education instructional

programs offered in grades 7-12 throughout the 50 states (National FFA, 2020). Over 12,000 agricultural educators teach these courses and even more teachers are beginning to incorporate agriculture into their lessons outside formal SBAE courses (NAAE, 2020). These instructors are tasked with providing quality agriculture programs to students within their respective schools.

To become an SBAE instructor an individual must have a minimum of a bachelor's degree, complete coursework in special education, meet the regency of study/experience rule (meaning that you earned at least 6 semester or 10 quarter hours of college credits within the 5 years prior to applying for certification, or that you taught out of state for 1 full year within 5 years of applying for certification. Before becoming a certified teacher, individuals must also have passed both the Georgia Assessments for the Certification of Educators (GACE) which involves basic skills testing and content area assessment testing (Georgia Teaching Certification, 2016). Georgia has three universities who offer teacher preparation for SBAE: The University of Georgia, Abraham Baldwin Agricultural College, and Fort Valley State University. At each university teachers learn about teaching pedagogy, but may also choose certain electives that will aid in their content knowledge within each respective agricultural field. For example, at the University of Georgia agricultural education students can take forestry classes such as "forestry for teachers" and "environmental education." In these classes students learn about the various techniques used in the forestry industry from tree and insect identification to cruising timber. Other topics within these forestry classes designed for new teachers include conservation practices, teaching with animals, and forest management.

SBAE programs provide students with educational experiences that reflect the dynamic and evolving agriculture industry (Phipps et al., 2008). These programs also prepare students for successful careers and a lifetime of informed choices in the global agriculture, food, fiber, and

natural resources systems (National FFA, 2020). Agriculture is vital to our everyday lives and an informed student body greatly aids in promoting agricultural literacy.

Agricultural Education Pathways

SBAE courses today are structured based upon a three-ring model that includes classroom/laboratory instruction, FFA, and SAE (Dailey et al., 2001). Each component of the agricultural education model works together to give students a high-quality educational experience (Phipps et al., 2008). During the traditional school hours of 8 a.m. to 3 p.m., students receive classroom/laboratory instruction from an agriculture education instructor. The knowledge taught in the classroom can be put to the test in competitions known as Career Development Events (CDE) offered through the FFA. SBAE students also design what is known as an SAE program during each agricultural course. An SAE program is intended to provide students with real-world application of the knowledge and skills that they have acquired (Phipps et al., 2008).

Schools wishing to implement high school agriculture courses have the option to choose from 45 different courses ranging from agricultural mechanics to small animal care (Georgia Agricultural Education Annual Report, 2019). Student interests in agricultural education have changed over the years and it is important to consult students to ensure that educational programs are tailored to meet the needs of today's learners. Modern agricultural education courses provide quality instruction to students of all ages including elementary, middle, secondary, post-secondary, and adult learning opportunities and outreach courses. The primary purpose of an agricultural education course is to create a more informed consumer and develop a generation that can support agriculture (Phipps et al., 2008). Agriculture is essential to life and an informed population is needed to ensure the growth and success of society.

Georgia SBAE programs are designed to offer a variety of pathways for schools to choose from. The creation and implementation of career pathways is a national trend in Career, Technical, and Agriculture Education (CTAE). To complete an agriculture pathway in Georgia, a student must pass a series of three approved courses within an assigned pathway area. There are many different agriculture pathways that Georgia schools may choose from for their school. These options range from animal science, forestry, horticulture, and agricultural mechanics to leadership, food science, and diversified agriculture (Georgia Department of Education, 2020). Of those areas, four major pathways are seen most often within Georgia schools: horticulture, animal science, forestry/natural resources, and agricultural mechanics (Georgia Agricultural Education Annual Report, 2019). Within a pathway, there is a set of three courses that a student must take to be a pathway completer. For example, a student who passes basic agricultural science, forest science, and wildlife management is a pathway completer in the forestry/wildlife systems pathway. Every pathway completer must first pass the basic agriscience and technology course. A student wishing to complete the forestry/natural resources pathway must also complete forest science for their second class, but have the option to complete wildlife management, natural resources management, or forest science II as their third pathway completing class (Georgia Department of Education, 2020). In recent years SBAE teachers have begun to develop methods of identifying what they perceive to be pertinent to their educational needs for the classroom, laboratory, and FFA (Joerger, 2002). Most schools implementing a forestry-related pathway choose to incorporate the forestry/wildlife pathway (Georgia Agricultural Education Annual Report, 2019). Agriculture Education Pathways are designed to generate student interest within specific agriculture careers while at the same time give students specific knowledge and skills to prepare them for employment within that specific area.

History of Forestry/Natural Resources Education

There have been varying definitions for forestry over the course of its evolution in the 19th century. Green (2006) defines forestry as "an interdisciplinary subject incorporating many scientific disciplines: soils, wildlife, civil engineering, economics, ecology, agriculture, environmental science, and recreation as well as silviculture and utilization of timber products" (p. 1). High schools and colleges in the United States have adapted their forestry curriculum to cover these differences and give a better understanding to their students about the forestry industry. The Society of American Foresters (2008) defines forestry education as "the profession embracing the science, art, and practice of creating, managing, using, and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs, and values" (p. 1).

The need for forestry education became more evident in the United States as the need for a response to growing concern that forests were being depleted and the country was in danger of experiencing timber famine (Hosmer, 1923). The beginning of formal forestry education can be traced back to the passing of the Morrill Act of 1863 which established state and federal land grant colleges to promote the development of SBAE (Green, 2006). These land grant colleges would specialize in promoting and educating students in agriculture-related topics. This act, coupled with other pieces of legislation involving the forestry industry, would begin to set in motion the idea of forestry education

In 1891 Congress passed the Forest Reserves Act, which created a reserve of 40 million acres of forestland in the United States. Six years later in 1897, Congress passed the Organic Act, which served as the basis for management of the newly created forest reserves (Society of American Foresters, n.d.). During that time there were less than 10 individuals in the United

States with any formal forest-management training, all of whom studied in Europe. In order to give formal forestry training in the United States, the Biltmore Forest School was established in 1898 and emphasized on a real-world education, concentrating on timber management in response to industry needs (Green, 2006). In 1889, George Vanderbilt hired Gifford Pinchot to manage the forest at the Biltmore Estate. Pinchot was a young forester also educated in Europe and became the manager of the nation's first professionally managed forest. This showed the beginnings of a commitment to forestry education. Rane (1906) discusses the importance of forestry when referring to it as this "new study" and the importance of getting children outside. Pinchot believed that high standards were essential to developing respect for the forestry profession that equaled that of other professions. On November 30, 1900, Pinchot asked seven professional foresters to join him in his office and this meeting resulted in the formation of the SAF (Society of American Foresters, n.d.). The SAF would later begin the accreditation of forestry programs.

As the SAF grew, so did its programs. The Journal of Forestry was published in January 1917 to bring the latest scientific information about forest management to its members. Graves and Guise (1932) classified forestry as the art based on the natural sciences that deals primarily with the production, management, and utilization of forests. This analysis of early forestry programs does not reference conservation although many of the programs covered range management, lumbering, forest engineering, and pulp and paper science especially in related or graduate degree programs (Graves & Guise, 1932). This definition of forestry along with the guidelines for the education of a forester continued to influence forestry education into the 21st century.

The beginning of a formal forestry curriculum began in the early 1930s. Chapman (1935) was asked to develop a classification of forestry curriculum and a list of approved schools. Fourteen schools were evaluated on the basis of the quality of teaching and the facilities, including the library, the laboratories, the research forests, and funding, which reflected the guidelines set forth by Graves and Guise. While no specific curriculum was designated, the rankings were based on the schools' distinction in the teaching of silviculture, management, economics, and utilization (Chapman, 1935).

Due to the accreditation policies of SAF, most forestry curricula did not drastically change from 1935 to 1963, but in 1963 Samuel Dana and Evert Johnson described the curriculum of recently re-accredited programs (Dana & Johnson, 1963). Undergraduate programs during this time focused on forest management with some expansion of such as pulp and paper technology and wood products. However, these descriptions probably do not truly reflect all the changes in the educational programs. Dana and Johnson (1963) mention that other disciplines, while not always present in the forestry curriculum, were often available to students and seen as important subjects that relate to forestry education. Range management, wildlife management, watershed management, outdoor recreation, conservation, and wood technology were all mentioned as being related to forestry, but also separate disciplines. Conservation was built into the forestry curriculum at this time and further expanded upon:

> Although schools of forestry have generally regarded forestry as dealing primarily with timber management, they have not hesitated to offer professional instruction dealing specifically with other resources either as separate curricula or as majors or options in a forestry program. This situation may be reflected in the name of the school, but more often is not (Dana & Johnson, 1963, p.15).

Forestry education continued to expand and enrollment numbers increased as programs diversified and changed their names. Interest in environmental issues also grew and terms such as forest resources, natural resources, environmental studies, environmental science, wildlife, and range sciences described programs, all indicating a broader category than the early 1900s forestry of tree utilization and forest management (Green, 2006).

In 1998, the Pinchot Institute for Conservation conducted a survey of forestry employers, recent graduates, and forestry educators to review the skills and competencies needed by graduates of forestry programs and discover the means by which forestry programs are addressing the changing needs of the profession (Green, 2006). The results of this survey were titled "The Evolution of Forestry Education in the United States: Adapting to the Changing Demands of Professional Forestry." Sample et al. (2000) include descriptions of 52 undergraduate programs that may be compared with earlier descriptions by Graves and Guise (1932) as well as Dana and Johnson (1963). Not all of these programs were SAF accredited (Green, 2006).

Dana and Johnson (1963) reviewed 28 accredited schools and only three did not use a forest-related term in their name at some level. Names do not always reflect the entire curriculum within a forest-related program, but name changes indicate efforts to reflect more interdisciplinary programs. This can also be true within today's high school forest science curriculum. Students that complete a forestry pathway have had a forest science course, but also a basic agriculture and wildlife management or natural resources management class in order to complete that pathway. The idea that exposure to forestry in high school is important to the future of the profession is not new. Schlosser (1988) mentions that efforts should be taken to

make sure high school students, in particular, are aware of the forestry profession because this is when many students make career choices.

Forestry education is also important within today's college curriculum. In a 2017 study, Lambert found that there was a change in the composition of the workforce in the agriculture, forestry, fishing, and hunting sector. There were fewer hours given to workers with less than a high school education and more hours were supplied by workers with some college, college degrees, or study beyond the bachelor's degree. There were substantial reductions in the total number of annual hours worked by people having less than a high school diploma from 1947 to 2010. There was a drop of 94% in the number of hours supplied to the sector by these workers and also a 28% reduction in hours supplied by people having a high school diploma, mostly occurring from 1980 onwards (Lambert, 2017). Many forestry/natural resource-related jobs require some type of college education, and some examples include certified forester, wildlife biologist, aquaculture manager, fish and game wardens, soil/plant scientist, and forestry teachers. This creates a need for forestry/natural resources to be taught more in our high schools while students are considering career choices, but there is also a need for more individuals pursuing post-secondary forestry degrees.

Barriers to Curriculum Implementation

Two challenges facing agriculture education today include the need for a critical mass of the next generation of agriculturalists interested in food and agriculture and to educate those who do not understand agriculture systems (Mercier, 2015). Certified agriculture educators are in great need in order to give quality instruction to agriculture students. NAAE (2020) notes that there are approximately 12,000 agricultural educators in the United States, but demand for those positions still outweighs supply. Along with the current shortage of agriculture teachers, there

are also challenges within the classroom that an agriculture instructor faces. An SBAE instructor has to deal with a variety of different barriers that can have a large impact on the manner in which concepts are taught and the way students learn (Johnson, 2007). Bandura (1994) suggested that an elevated sense of self-efficacy can combat the barriers and setbacks that distinguish tough activities. For this to be possible, instructors must develop a greater sense of self-efficacy.

Dobbins and Camp (2003) noted a need for understanding in curriculum development, learning styles, technical areas, teaching methods, teaching techniques, and academic integration methods. Barriers in implementing specific natural resources curriculum may include a lack of natural spaces to conduct activities, little administrative support, limited time, and lack of teacher comfort and confidence with science concepts (Shumacher et al., 2012). Each of these factors poses a challenge for an instructor to effectively teach their subject matter. Rosenshine and Furst (1973) concluded that the three most important teacher-effectiveness variables were clarity, variability, and enthusiasm.

There can also be additional internal and external challenges to teachers with less experience in the classroom. Mundt (1991) found that early-career agriculture teachers faced problems such as organization, time-management, lesson planning, discipline, and planning of FFA events. Not only can these barriers affect the manner in which students learn, but they can also have an effect on whether or not agriculture teachers may implement specific curricula within their classrooms. Some studies suggest that post-secondary enrollment numbers have been low within forestry/natural resource programs which may indicate a lack of interest in the subject. Undergraduate enrollment in United States forestry degree programs has been dropping at about 4% per year from the mid-1900s through the early part of the 21st century (Sharik et al., 2004). The number of African Americans who major in forestry/natural resources management

programs is also disappointingly small (Bettis et al., 2017). With degree numbers declining in this field this could be an indication of interest level declining within forestry/natural resource education.

Content Knowledge and Experience

There is a great demand for agriculture instructors and even more so for those that have the content knowledge to teach classes within the forestry and natural resources fields. The attrition rate for novice teachers can range between 20% to 50% in the first 5 years of teaching (Hughes, 2012). Some percentage of these attrition rates could be due to their lack of content knowledge and self-efficacy. Theorist Albert Bandura (1994) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). Some studies suggest that self-efficacy may increase as teaching experience increases. Stripling et al. (2008) found that students at the University of Georgia and Texas A&M University had increasing self-efficacy scores as their student teaching progressed. While pre-service teaching efficacy is the highest during the pre-service years, Hebert et al. (1998) noted that it decreases during the first year of teaching. Swan et al. (2011) also found in a study of new teachers (1-3 years) that the lowest levels of teacher self–efficacy were at the conclusion of their first year of teaching. This finding supported earlier research where teacher self–efficacy declines during the first year of teaching which could be attributed to the absence of the cooperating teacher or supporting mentor (Woolfolk Hoy & Burke–Spero, 2005). This decline in teacher self–efficacy is upsetting, but may explain some of the attrition that occurs after the first year of teaching. Whittington et al. (2006) and Swan et al. (2011) note an increase in teacher self–efficacy from the first year of teaching to the second year of teaching. These findings may

also suggest that teacher confidence and performance increases as teachers gain more in-field teaching experience.

Experience levels can also play a role in content knowledge and varies from each SBAE teacher. Teaching experience could include the number of years that the instructor has been in the classroom or the experience within the industry that a teacher has gained. Groves (1977) studied variables related to a teacher's knowledge and opinion of natural resources as well as their methods for teaching a forestry unit. Results from this study showed that graduate school type, area of study, type of community lived in as a youth, and type of undergraduate school related to their natural resource knowledge. Teacher opinions about natural resources were related to the number of conservation or outdoor recreational activities they participated in both at the time of study and during their youth.

SBAE curriculum can vary greatly depending on the technical area and it can be challenging for a new teacher to be fully effective. Mundt (1991) found that early-career SBAE teachers faced problems such as organization, time management, lesson planning, discipline, and planning of FFA events. While pedagogy and classroom management are very important to teaching any class, pre-service agriculture teachers receive little content-specific training. Shulman (1987) believed that teacher education programs should combine both content and pedagogy to more effectively prepare teachers. This would provide for a more well-rounded agriculture instructor upon completion of the degree. Moreover, teachers receive little program management assistance in many areas related to SBAE from their respective school districts (Greiman et al., 2002).

Being exposed to forestry curricula could be a means of presenting possibilities to middle school, high school, and post-secondary students. Lack of knowledge about forestry has been

thought to be one reason that enrollment is declining at the National Association of University Forest Resource Programs (Shairk & Frisk, 2011). Nuangchalerm (2011) noted that teachers must be given the skills and knowledge to develop pedagogical content knowledge (PCK). PCK is defined as the ability to combine knowledge of a specific discipline along with the teaching of the discipline and addressed the importance of integrating subject matter knowledge and pedagogy into teaching (Nuangchalerm, 2011). Kane and Russell (2005) mention that PCK involves knowledge of teaching strategies that incorporate the most appropriate methods, create learning environment situation, and prior conceptions. Learning effective teaching strategies is important, but even more important is developing a deeper knowledge of the content being taught. Goodnough and Hung (2009) describe how subject matter of a particular discipline is transformed for teachers and students that enhance effective communication. Of the 103 natural resources teachers surveyed in Groves et al. (1977) study, it was found that "knowledge is obtained through formal education and community background factors, opinion is influenced by current teaching experience and recreational activities" (p. 32).

Hartfield (2011) looked at the difference in teacher self-efficacy between novice and experienced Arizona SBAE teachers. There was 93 Arizona teachers included in the sample and four domains researched: classroom instruction, FFA, SAE, and content knowledge. Content knowledge was based on the curriculum used by the Arizona Department of Education. FFA had the most self-efficacy and the highest perceived level of importance. Content reported the least amount of efficacy and received the lowest importance in this study. Friend (2008) surveyed West Virginia agricultural education teachers to determine the knowledge and attitudes of forestry education. Respondents of the study were most confident teaching about tree parts, forestry careers, chainsaw use, tree growth, and reproduction. Approximately 95% of those

respondents agreed or strongly agreed that forestry should be a class taught by agricultural education teachers. When looking at the challenges that these teachers faced, most frequently mentioned was a lack of knowledge followed by lack of resources, lack of time, and lack of student knowledge (Friend, 2008).

Emphasis and Interest Levels

Instructor interest levels and motivation are characteristics to consider when studying barriers to the implementation of forestry/natural resources curriculum. The amount of emphasis that an instructor places on forestry/natural resources curriculum aspects is of great importance. According to Yildirim (1994), students are "more comfortable with learning in structured ways and often are not eager and enthusiastic about new ideas and perspectives" (p. 3). Emerging and unfamiliar issues provide many different sets of challenges for an SBAE teacher and especially an instructor with a pathway in natural resources. A 2007 survey found that teenagers do not recognize professional career opportunities in forestry and that forestry is the least popular of the natural resource fields (Hagar et al., 2007). If this stigmatism is to be overcome, then it first must be overcome by the instructor. An instructor within natural resources has the distinct advantage of being able to provide students with hands-on experiences that truly help students visualize certain aspects and points within the curriculum. Pineda's et al. (2011) case study involving the implementation of a 3-phase, 10-week course for the application of experiential learning and experiential education methods is an example of the importance of hands-on learning needed within forestry/natural resources classes. According to student response and evaluation, the course was successful at expanding their knowledge of sustainability in both application and theoretical context.

Knowing what an instructor views as important and how much competence they have in that topic is an important aspect in viewing how it is emphasized in the classroom. In Clemons' et al. (2018) study of Alabama teachers in grades 9-12 it was found that teachers felt that teaching skills and concepts in environmental sciences (wildlife management, forestry, ecology) was between important and very important ($MI^a = 4.18$). Those teacher's competence level was found to be between somewhat competent to competent ($MC^b = 3.71$) of which was a lower competence score in comparison to teaching skills and concepts in animal sciences or plant sciences.

Perry (1998) surveyed K-12 teachers in Oregon to measure their knowledge of and attitudes toward agriculture and natural resources curriculum. Results indicated that science teachers and teachers from rural areas are more likely to be aware of agricultural and natural resources curricula such as FFA, 4H, and Project Learning Tree. While teachers reported that they had a positive attitude toward these programs, only a small percentage of teachers had actually received program training. Several studies have also researched teacher attitudes toward environmental education. Lane and Wilkie (1994) surveyed teachers to determine their perceptions of environmental education. Sebasto (1998) also conducted a study with similar objectives on the University of Illinois Cooperative Extension Service Educators. Both of these studies found that teachers believe environmental education is very important but they actually incorporate very little. Furthermore, both studies found limited backgrounds in environmental education were a main reason for low integration levels (Lane & Wilke, 1994; Sebasto, 1998).

Teachers feel that the subject of forestry and natural resources is an important part of curriculum within high schools. Fowler (2012) conducted a survey of high school science teachers in the Southern Piedmont region of the United States by investigating their forestry

education attitudes and teaching practices. Results indicated that 82% of those teachers agree forestry should be taught in high schools and do so most frequently by presenting forestry concepts in the context of ecosystem services followed by physical and physiological characteristics of trees. Concepts related to products, uses, and management are taught less frequently. Variables that predict teaching frequencies for each of these three groups include classes taught in the last 5 years, environmental education program training, and childhood location in addition to attitudes toward and knowledge of forest management. Only 34% of these teachers agreed or strongly agreed that they feel confident to teach forestry concepts. Fifty-eight percent of respondents agreed or strongly agreed that they would like to receive more training in forestry (Fowler, 2012).

Bettis et al. (2017) looked at what factors influenced African American students to pursue degrees in forestry and natural resources management, what demographic characteristics can be used to explain variance in the influence of factors, and what data can provide insight and could inform the professions of ways to recruit African American students into forestry/natural resources management programs (Bettis et al., 2017). Most of the students indicated that forestry and natural resources management work experience and attraction to the outdoors were factors which influenced their career choice. The researchers further stated that the minority subject in this study favored science projects with laboratory settings rather than outdoor settings.

SBAE teachers also deal with a variety of outdoor settings and field trips that can be beneficial to student learners, but also pose challenges to the instructor. Simmons (1998) conducted a study in which teachers were interviewed to determine which of four outdoor settings were most appropriate for field trips as well as the perceived benefits and barriers of field trips. Teachers believed that deep woods and rivers/ponds/marshes were more appropriate

than urban nature, but that these areas presented significantly more hazards. Teachers believed that field trips to natural areas were a benefit to the curriculum, that students would enjoy the experience, and that the field trips held educational value. Teachers reported that they did not feel comfortable teaching in natural settings, did not believe they had adequate training or the necessary background to do so, and were concerned about student safety and large class sizes.

Theoretical Frameworks

SBAE can be a wonderful educational experience for high school students involved. Students have the opportunity to make important links between academic learning and real-world application. SBAE can even assist in developing a more agriculturally literate society that can make informed consumer decisions while also fostering the growth and development of the agriculture industry as a whole. However, SBAE can do nothing without developing a curriculum to meet the learning needs of the modern student and being able to attract students to enroll within the programs across the United States. In order to assess this an appropriate framework must be used. The theory used as a basis for this study is Borich's Needs Assessment Model.

Needs Assessment Model

Borich's needs assessment model is useful because it produces clear and specific recommendations that the researcher can use for professional growth and development. Institutions that train individuals are continually looking for ways to improve their training programs. Borich (1980) developed a model of needs assessment designed to improve the training programs of institutions for professional development. The Borich Needs Assessment Model utilizes Mean Weighted Discrepancy Scores (*MWDS*) to identify the need priorities of participants of a particular program (Ashraf et al., 2020). This model measures the discrepancy

between the goals of a program or organization and performance of participants of that program or organization. The concept of evaluation implied in the model is determining "what is and what should be," what the teacher should be able to do and what the teacher can do (Borich, 1980). Borich's Needs Assessment Model includes the following steps:

1. Both desired and existing (Importance or Ability) competencies should be listed in the questionnaire
2. Circulate the questionnaire among the participants /respondents
3. Data tabulation on MS Excel
4. Calculate the discrepancy score by subtracting Ability from Importance
5. Calculate the WDS by multiplying the overall mean of Importance with the discrepancy score
6. Find the mean of WDS to determine the MWDS
7. Rank the competencies by employing the MWDS in numerical order to identify the prioritized training needs

The difference between competency ratings and importance ratings is an ideal measure when assessing areas of in-service needs, technical agriculture, leadership development, teaching and learning, and program management (Clemons et al., 2018). This has become a popular method in identifying agricultural education pre-service and in-service needs assessments. Researchers in education wishing to use this incorporate a modified version of the Borich Needs Assessment Model to evaluate the "perceived level of importance" and "perceived level of competence" of teachers regarding professional competencies that were identified by previous research and related to the issues of their respective states (Garton & Chung, 1996; Joerger, 2002; Layfield & Dobbins, 2002). While Garton and Chung (1996) utilized a quadrant analysis,

Edwards and Briers (1999) compared the ranking of in-service needs as determined by direct evaluation to a ranking based on a mean weighted discrepancy score (*MWDS*), i.e., the Borich model. They determined that looking at *MWDS* may be more effective than a direct assessment.

In 2002 Joerger modified Borich's Needs Assessment instrument and created a new instrument which was modeled after Garton and Chung's (1996) research. The categories of teaching and classroom management, leadership and SAE development, technical agriculture, and program design and management, identified by Joerger, best represent the needed competencies associated with the total program philosophy of agricultural education. Due to Edward's and Brier's finding that an assessment tool similar to the Borich model was more effective than direct assessment, and Joerger's, Garton's and Chung's continuing revision and refining of the Borich Needs Assessment instrument, it was determined to be the best instrument to achieve the purposes of this study.

Chapter Summary

The purpose of Chapter 2 was to provide a description of the literature base and theoretical frameworks that served as a guide for this study. The literature review provided an in-depth evaluation of relevant studies and findings that contributed to the overall study design. The literature in Chapter 2 focused on teacher's perceptions of forestry/natural resource curriculum and factors that may affect the implementation of those concepts. Those factors included a variety of internal and external barriers to curriculum implementation. This study will focus on the internal barriers broken down into teaching experience, content knowledge, and teacher emphasis and interest levels.

Educating teachers and students about forestry/natural resources curriculum can prepare students with the knowledge and skills necessary to enter into one of Georgia's top agricultural

industries. The quality of instruction that instructors provide their students can be enhanced by minimizing barriers that teachers experience planning and implanting forestry and natural resources curriculum. There is a lack of research on the barriers that teachers experience in the classroom within specific agricultural subjects. It is an important area of research because by identifying these perceived barriers universities, state staff, and other stakeholders can provide the tools necessary to better classroom instruction for new and current agriculture educators.

It is important that a forestry and natural resource instructor structure his or her program to prevent possible barriers in teaching and learning. Effectively designing forestry/natural resources curriculum is also essential in combating teacher barriers. The process of designing the curriculum allows the teacher to develop expertise in a new area. The next chapter provides a detailed description of the methods and procedures used during this study.

CHAPTER III
METHODOLOGY

Introduction

The purpose of this study was to determine teacher perception of forestry/natural resources curriculum in an effort to investigate barriers that teachers may be experiencing when implementing that curriculum. To accomplish this purpose, this project developed an instrument based on prior research literature, Georgia teaching standards, and SBAE teachers' perception of importance and competence. The methods and procedures used in developing and conducting this research study are described in this chapter.

Scope and Population of the Study

SBAE programs exist to meet the needs of business and industry within the community. The agriculture curriculum students are exposed to could vary depending on the region in which they live. The study included a representative sample of SBAE teachers from the three regions found in Georgia (North, Central, and South). The population for this descriptive and correlational study included all secondary agriscience teachers in Georgia (N = 358). The population included both male and female in-service agriculture teachers holding a valid Georgia agriculture teaching certificate and having at least one year of teaching experience. A list of all SBAE teachers across the state was requested through the researchers work email. A private excel list was acquired by the state program manager. The list contained school name, county name, area, region, and teacher name. All middle school agriscience teachers (n = 95) were excluded from the study due to difference in high school and middle school Georgia Performance Standards that were used as a part of the survey instrument. Email addresses were accessed from the agriculture education teacher directory. There were 138 (n = 138) high school teachers in the North Region (69 in both Area 1 and Area 2), 111 (n = 111) in the Central Region

(61 in Area 3 and 50 in Area 4), and 109 (n = 109) in the South Region (55 in Area 5 and 54 in Area 6). In order to help assess the reliability and validity of the survey instrument a pilot study was conducted. The pilot study participants included 15 (n = 15) secondary agriscience teachers in Georgia which were representative of the population being investigated. Participants of the pilot study were not included in the research study.

Human Subjects Review Board

Federal regulations and Auburn University policy require the Human Subjects Review Board to approve all research studies that involve human subjects before any research can begin. One of the primary functions of the Human Subjects Board is to ensure federal, state, and university policies are followed when conducting research. Auburn University's Human Subject board conducted the review of this study to protect the rights and welfare of human subjects involved in behavioral research. This study received proper review and was granted permission to proceed with the research survey. The Auburn Human Subjects Review Board assigned protocol number 20-524 to the research project (Appendix A).

Study Design

This descriptive research study used a quantitative non-experimental survey design. Ary et al. (2010) mentions quantitative research as the examination of operational definitions to produce numeric data to answer pre-determined hypotheses, research question and/or research objectives. Ravid (2011) was even more descriptive about quantitative research when mentioning that this type of research focuses on explaining the relationship between cause and effect, includes a small number of variables, and involves numeric data. Holton and Burnett (1997) report that a major advantage of quantitative research is the ability to use a smaller group of people to make inferences about larger groups that would be too expensive to study. This study

sought to observe relationships and discrepancies, but not manipulate any variables thus making it non-experimental in nature (Ary et al., 2010).

When conducting research, it is important to address possible threats to data within the study. Dillman et al. (2014) discusses four major types of survey errors that researchers may encounter and should minimize when collecting data in research: coverage error, sampling error, non-response error, and measurement error. Coverage error arises when the population features that the researcher wishes to estimate are not represented by the population samples. The first step in minimizing coverage error within this study used an internet-based survey that made it easier for the researcher to disseminate and the population to complete. Lavrakas (2010) notes that the internet could be a viable alternative to other survey modes when conducting research. Another means in which this study minimized coverage error was by surveying all Georgia high school agricultural education teachers with more than 1 year of experience. This ensured that teachers from the North, Central, and South regions of Georgia had the opportunity to compete the survey and that there was no bias introduced from teachers with less than 1 year of teaching experience. This also minimized sampling error which has been defined as the "extent to which the precision of the survey estimates is limited because only some people from the sample frame are selected to complete the survey (i.e., sampled) and others are not" (Dillman et al., 2014, p. 4).

The third type of error reported by Dillman et al. (2014) is nonresponse error. Non-response error is when the characteristics of respondents differ from those who chose not to respond in a way that is relevant to the study results. Linder et al. (2001) mentions that nonresponse error has received less attention than the other three types of error. It was anticipated that not all teachers who received a survey would respond. Failure to address non-response error is an issue within social science. Response rates as high as 90% have the potential

for nonresponse error (Linder et al. 2001). Lindner and Wingenbach (2002) reviewed brief research articles in the Journal of Extension from 1995 through 1999 and found that non-response error was a threat to external validity in 82% of the articles. Research done that contains low response rates is questionable because little is known of the differences between respondents and non-respondents (Wiseman, 2003). Linder et al. (2001) also studied article in the Journal of Agriculture Education from 1990 to 1999 and found that failure to address nonresponse was a threat to external validity. A method to minimize this type of error would be to compare respondents to nonrespondents (Lindner et al., 2001). The use of a pre-notification was used to stimulate response rate. Dillman et al. (2014) quotes a number of experiments that tested pre-notice letters and achieved an improvement of response rates between 3% and 6%. Participants were notified of the study through the researcher's agriculture education email 4 days before the distribution of the study explaining the purpose, informed consent for participation, and the dates of the study. Respondents that see names and organizations they trust are more likely to respond to questionnaires (Perkins, 2011).

The fourth type of survey error reported by Dillman et al. (2014) involves measurement error. When designing a survey, there are many measurement challenges. Measurement error results from a discrepancy in unobserved variables and the survey responses. In order to minimize measurement error, this study sought to have clearly worded questions that were properly ordered, easily taken by the respondent, and non-biased. According to Dillman et al. (2014) questionnaire length, complexity, and legitimacy of questions may negatively affect response rates. Content validity and face validity were also addressed in order to minimize measurement error within this study. Content validity is the "extent to which a specific set of items reflects a content domain" (DeVellis, 2003, p. 49). Face validity is the general appeal and

appearance of the instrument and whether the instrument appears to measure what is proposed to measure. Content validity was addressed by ensuring the items on the questionnaire represent the Georgia Performance Standards within the Basic Agriscience and Technology course that relate to the forestry field (forest science, natural resources management, and wildlife management). Face validity was established by the researcher and faculty members at Auburn University.

Another means of addressing the reliability and validity of the survey instrument included conducting a pilot study. The pilot study participants included 15 (n = 15) high school agriscience teachers in Georgia which were representative of the population being investigated but were not included in the final analysis. There were 17 participants (n = 17) invited to participate in the pilot study and asked to complete the survey instrument while also filling out an interval measurement scale that addressed the following variables: clarity of directions, choice of responses, layout, flow, level of appropriateness of the statements/questions, and organization and ease of use in the Qualtrics software program to account for content and face validity (Appendix B). There were 15 (n = 15) individuals that completed the pilot study yielding a response rate of 88%. The population was representative of the target population but was not included in the final study population.

Using SPSS, Version 27, the Pearson's reliability test was utilized to determine the degree of internal consistency for the pilot study. The reliability test was run for each construct, both importance and competence scales, and for the entire Borich scale. The natural resources management construct consisted of 10 items and demonstrated adequate reliability in the sample (Cronbach's α^I = .829 and α^C = .960) where I = Importance and C = competence. The forest science construct consisted of 10 items, and demonstrated high reliability in the sample (Cronbach's α^I = .873 and α^C = .969). The wildlife management construct consisted of eight

items, and demonstrated high reliability in the sample (Cronbach's α^I = .855 and α^C = .970). The entire instrument demonstrated high reliability in the sample (Cronbach's α^I = .906 and α^C = .982). Once determining the instrument was sound and IRB approval was met, the survey instrument was sent to all secondary agriscience teachers in Georgia not included in the pilot study (N = 343).

Participants within this study completed a two-part questionnaire designed and conducted through Qualtrics. The instrument was designed using influences from Clemons et al., (2018), Duncan et al. (2006), and Borich's Needs Assessment Model (1980). Borich's (1980) needs assessment model was mainly intended to measure the level of competence individuals had upon completion of some form of training program. Borich (1980) also notes that this model could be modified, extended, and adapted to meet a variety of institutional needs: "The needs assessment model yields more data, and more understandable data, than many other types of follow-up questionnaires" (Borich, 1980, p. 42). This model is beneficial because it provides direct and clear-cut recommendations that can be used for program growth and development. By using a link and multiple-choice style questions participants are more likely to complete the study. Using this design will help guide the types of answers and begin to gain some data in an area that has little findings. The cost and time requirements are also low (Mertler, 2018).

Instrumentation and Data Collection

The Borich type instrument consisted of 26 items that were framed by the concepts within three subject standards of the Basic Agriscience and Technology Georgia Performance Standards (natural resource management, forest science, and wildlife management). Participants were asked to give their perceived importance on one side of each question and perceived competence on the other side of that same item (Appendix C).

Participants were notified in advance regarding the study through the researcher's agriculture education email and 4 days later an invitation to participate in the study was sent through Qualtrics platform. Dillman et al. (2014) supports the use of questionnaire-based software programs for improved design, data control, access, reporting, and cost. Advantages of time, cost, and data entry are cited as the most appealing features of web-based surveys (Wright, 2005). The Qualtrics platform provided the opportunity for teachers to easily complete the survey instrument while also producing the data necessary to address all research objectives. Ary et al. (2010) mentions survey research as examination where a researcher asks multiple questions relating to peoples' characteristics, beliefs, opinions, and actions. Survey research can be used in a descriptive manner, but it can also be used to investigate relationships between variables (Fraenkel et al., 2012).

The data collection process was conducted between November and December, 2020. Participants completed the 10-minute questionnaire on any computer or device and data was immediately collected. Participants were contacted through email and given a unique link to the questionnaire and information letter discussing the parameters of the study (Appendix D). Stern et al. (2009) notes that providing instructions for accessing and completing web surveys may help convince potential respondents to complete the survey that may not otherwise. Dillman et al. (2014) stresses the inclusion of web instructions will help increase response rates. In order to address threats to external validity it was important to obtain a sample that was representative of agriculture teachers across the state of Georgia. Potential threats and/or sampling bias could include receiving less than 50 completed surveys. Mertler (2018) notes this leaves a large number of surveys not returned could introduce potential bias to the results. This method allowed

teachers to complete the survey with ease while providing the information necessary to address the research question.

The survey had an initial response of 52 respondents (n = 52, % = 15). A total of three email reminders were sent through the Qualtrics platform, each being approximately 7 days apart. Individuals who had either not started or not completed all the items on the questionnaire were included in the email reminder list. A final reminder was sent to unfinished respondents through the researcher's department of education e-mail address. Dillman, et al. (2014), emphasizes that each approach to the respondent needs to be as different as possible from the previous one. The email reminders yielded 38 (*n* = 38, % = 11), 48 (*n* = 48, % = 14), and 49 (*n* = 49, % = 14) additional respondents, respectively. The total survey yielded 187 responses and a response rate of 54% (n = 187, % = 54).

Data Analysis

Data was analyzed using SPSS 27. SPSS is a complete statistical analysis package that can easily analyze descriptive techniques as well as generate high-quality graphs and charts (Mertler, 2018). After completion of the instrumentation period partially completed surveys were excluded from the sample resulting in a total of 171 secondary agriculture teachers (*n* = 171). Results from the study were analyzed using Mean Weighted Discrepancy Scores (*MWDS*) and various personal characteristics such as age, years of experience, gender, teaching backgrounds, and ethnicity. Names of respondents were removed from the database.

Analysis of SBAE teacher perceptions will aid in professional development opportunities provided by state staff and universities. Each of the research objectives listed was analyzed according to the data collected. Research objective one was to identify and describe the personal characteristics of high school agricultural education teachers in Georgia. This objective was

addressed by providing means, frequencies, and standard deviations to describe the participants. Research objective two seeks to describe the perceived importance of the forestry and natural resources curriculum for high school agricultural education teachers. Research objective three sought to describe the perceived level of instructor competence of the forestry/natural resources content from within Basic Agriscience and Technology course standards. For both objective two and three a Borich analysis was used to determine both perceived level of importance and perceived level of competence of forestry/natural resources content from within Basic Agriscience and Technology course standards. Weighted Means were calculated in order to determine a *MWDS* for each individual item as well as each construct (Borich, 1980). This has become a popular method in identifying agricultural education pre-service and in-service needs assessments. This model measures the discrepancy between the goals of a program or organization and performance of participants of that program or organization. The concept of evaluation implied in the model is determining "what is and what should be," what the teacher should be able to do and what the teacher can do (Borich, 1980). Borich's Needs Assessment Model includes the following steps:

1. Both desired and existing (Importance or Ability) competencies should be listed in the questionnaire
2. Circulate the questionnaire among the participants /respondents
3. Data tabulation on MS Excel
4. Calculate the discrepancy score by subtracting Ability from Importance
5. Calculate the WDS by multiplying the overall mean of Importance with the discrepancy score
6. Find the mean of WDS to determine the MWDS

7. Rank the competencies by employing the MWDS in numerical order to identify the prioritized training needs

Chapter Summary

Chapter 3 identified the methods utilized within this study. This descriptive research study used a quantitative non-experimental survey design to describe teacher perceptions of importance and competence within forestry/natural resource-based standards. The chapter included a detailed description of the scope and population, Human Subjects Review Board, study design, measures of validity and reliability, instrumentation and data collection, and data analysis. The study design included the analysis procedures along with the rationale for method selection. The methods outlined in this chapter were followed in an attempt to collect the data needed to provide insight into the research question and guiding objectives for this study. The sample included teachers from the six areas of Georgia in order to get a representative sample of agriculture teachers across the state. Teachers completed a two-part web-based questionnaire designed using the Qualtrics platform. A variety of analysis procedures were used to analyze and report on the collected data including frequencies, percentages, means, standard deviations, *MWDS*, t-tests, and ANOVAs. The following chapter describes the findings of these analyses.

CHAPTER IV
FINDINGS

Introduction

The purpose of this study was to investigate Georgia secondary agriscience teachers' perception and attitudes regarding barriers they may experience when implementing forestry/natural resources curriculum in the classroom. This chapter will highlight the findings of the study that were guided by the following research objectives:

1. Identify and describe the personal characteristics of high school agricultural education teachers in Georgia.
2. Describe the perceived importance of the forestry and natural resources curriculum for high school agricultural education teachers.
3. Describe the perceived level of instructor importance and competence of the forestry and natural resources curriculum for high school agricultural education teachers.

Analysis by Study Objective

This descriptive research study used a quantitative non-experimental survey design. All Georgia SBAE teachers with more than 1 year of experience were surveyed (N = 343) and a total of 171 (n = 171) responses were analyzed. Participants within this study completed a two-part questionnaire designed and conducted through Qualtrics. The instrument was designed using influences from Clemons et al., (2018), Duncan et al. (2006), and Borich's Needs Assessment Model (1980). The findings presented in the chapter are based upon the research questions and objectives that guided the study.

Personal characteristics of respondents within this study are presented in Table 1. Personal characteristics of the sample indicated consistency with the population in Georgia at the time of the questionnaire (Hughes, 2020; Personal Communication, March 20, 2020). Overall,

187 Georgia high school agricultural education teachers completed the questionnaire, partial responses were excluded yielding a sample of 173. Male teachers comprised the largest gender group of participants (*n* = 99, % = 57.22), while female respondents represented 42.19% (*n* = 73), and 1 participant marked "other" (*n* = 1, *%* = 0.58). There were 164 respondents (*n* = 164, % = 94.79) that reported Caucasian/White for ethnicity while there were two (*n* = 2, % = 1.16) Hispanic/Latino and seven (*n* = 7, % = 4.05) Black/African American respondents. The teaching experience group with the highest number of participants were those with 1 to 5 years of teaching experience (*n* = 53, *%* = 30.64). The remaining participants represented the groups of teaching experience in the following breakdown: 6-10 years (*n* = 35, *%* = 20.23), 11-15 years (*n* = 33, *%* = 19.08), 16-20 years (*n* = 29, *%* = 16.76), and more than 20 years (*n* = 23, *%* = 13.29). The breakdown agricultural education regions within the state were also representative of the Georgia teaching population with 46.84% (*n* = 81) reporting from the north region, 25.42% (*n* = 44) from the central region, and 27.74% (*n* = 48) from the south region. It was expected that there would be more respondents from the north region due to the size difference with that of the central and south regions. Over half of the participants reported living in a rural community setting (*n* = 116, *%* = 67.05), with the remaining participants reporting 10.40% (*n* = 18) in urban community settings, and 22.54% (*n* = 39) in suburban community settings. Additional data analysis concerning community setting will not be conducted due to a lack of clarification and understanding on the exact definition of each setting among participants. Participants were also asked to identify the highest degree earned. The representation of degrees was mostly even with the exception of respondents that have a doctorate degree (*n* = 7, % = 4.05). The remaining participants represented highest degree earned in the following breakdown: bachelor's (*n* = 49, % = 28.32), master's (*n* = 69, % = 39.88), and specialist (*n* = 48, % = 27.75).

Table 1

Personal Characteristics of Georgia High School SBAE Teachers

		n	%
Gender	Male	99	57.22
	Female	73	42.19
	Other	1	0.58
	Total	173	100.00
Ethnicity	Caucasian/White	164	94.79
	Hispanic or Latino	2	1.16
	Black or African American	7	4.05
	Total	173	100.00
Teaching Experience	1-5 years	53	30.64
	6-10 years	35	20.23
	11-15 years	33	19.08
	16-20 years	29	16.76
	More than 20 years	23	13.29
	Total	173	100.00
Ag Ed Region	North	81	46.84
	Central	44	25.42
	South	48	27.74
	Total	173	100.00
Community Setting	Rural	116	67.05
	Urban	18	10.40
	Suburban	39	22.54
	Total	173	100.00
Highest Degree	Bachelor's	49	28.32
	Master's	69	39.88
	Specialist	48	27.75
	Doctorate	7	4.05
	Total	173	100.00

c

Forestry/natural resources characteristics for Georgia agriculture teachers within this study are presented in Table 2. Upon beginning the survey teachers were asked to identify if they have experience teaching a forestry/wildlife pathway. Responses included "Yes, I currently teach

the forestry/wildlife pathway" (*n* = 41, % = 23.7), "Yes, I have taught the forestry/wildlife pathway in the past, but am not currently teaching it" (*n* = 38, % = 22.0), "No, I am not currently teaching the forestry/wildlife pathway and have no plans to in the future" (*n* = 60, % = 34.7), and "No, I am not currently teaching the forestry/wildlife pathway, but would like to in the future" (*n* = 34, % = 19.7). Participants were also asked to identify any career experience or personal experiences that they have had in forestry, natural resources management, wildlife management, or none of these. Responses included allowing the participants to make multiple selections.

Table 2

Forestry/Natural Resource Characteristics of Georgia SBAE Teachers

Question	Subject	*n*	%
YES, I currently teach the forestry/wildlife pathway.		41	23.7
YES, I have taught the forestry/wildlife pathway in the past, but am not currently teaching it.		38	22.0
NO, I am not currently teaching the forestry/wildlife pathway and have no plans to in the future.		60	34.7
NO, I am not currently teaching the forestry/wildlife pathway, but would like to in the future.		34	19.7
	Total	173	100.00
Career Experience	Forestry	20	11.6
	Wildlife Management	24	13.9
	Natural Resources Management	28	16.2
	None of these	127	73.4
Personal Experience	Forestry	72	41.6
	Wildlife Management	78	45.1
	Natural Resources Management	64	37.0
	None of these	73	42.2

Teachers were asked to rate 26 items based on the Basic Agriscience and Technology curriculum standards using a Likert-type scale described in the methods. The instrument designed used influences from Clemons et al., (2018), Duncan et al. (2006), and Borich's Needs

Assessment Model (1980). Three standards within the Basic Agriscicnce course were used in order to produce the 26 items on the scale. Those standards were based on natural resource management, forest science, and wildlife management concepts and separated according to those three areas.

The Pearson's reliability test was utilized to determine the degree of internal consistency for the results of the study. Cronbach's alpha (α) was determined for each construct, both importance and competence scales, and for the entire instrument. The natural resources management construct consisted of 10 items and demonstrated high reliability in the sample (Cronbach's α^I = .916 and α^C = .927) where *I* = Importance and *C* = competence. The forest science construct consisted of 10 items, and demonstrated high reliability in the sample (Cronbach's α^I = .919 and α^C = .944). The wildlife management construct consisted of eight items, and demonstrated high reliability in the sample (Cronbach's α^I = .915 and α^C = .928). The entire instrument demonstrated high reliability in the sample (Cronbach's α^I = .956 and α^C = .962).

The perceived importance of natural resource concepts under the Basic Agriscience and Technology course Standard 6: Describe soil formation and management and assess its relevance to plant/animal production and natural resources management is presented in Table 3. The top three reported items of perceived importance in the natural resources construct were "Teaching about careers in the Natural Resources industry" (*M* = 4.32), "Teaching concepts in soil erosion" (*M* = 4.24), and "Teaching soil components" (*M* = 4.14).

Table 3

Perceived Importance of Natural Resources Concepts

Question Variables	M^I	*SD*
Natural Resources Construct	3.99	0.79
Teaching about careers in the Natural Resources industry.	4.32	0.71
Teaching concepts in soil erosion.	4.24	0.71
Teaching soil components.	4.14	0.68
Teaching concepts in soil texture.	4.05	0.71
Teaching concepts in soil formation.	3.95	0.75
Teaching concepts within soil ecosystems.	3.89	0.78
Teaching concepts in selecting appropriate soil management practices for a given land class.	3.77	0.89
Teaching concepts in slope.	3.68	0.91
Teaching how to determine land class on a given site.	3.60	0.96

Note. n = 171; M^I=Importance (1=Not important, 2=Of little Importance, 3=Somewhat important, 4=Important, 5=Very Important); Cronbach's α^I = .916.

The perceived importance of forest science concepts within Basic Agriscience and Technology course Standard 10: Demonstrate basic skills in natural resource management is described in Table 4. The top three reported items of perceived importance in the forest science construct were "Teaching about careers in the forestry industry" (M = 4.29), "Teaching about tree functions" (M = 4.21), and "Teaching identification of important species of trees in Georgia" (M = 4.13).

Table 4

Perceived Importance of Forest Science Concepts

Question Variables	M^I	*SD*
Forest Science Construct	4.02	0.80
Teaching about careers in the forestry industry.	4.29	0.70
Teaching about tree functions.	4.21	0.65
Teaching identification of important species of trees in Georgia.	4.13	0.77
Teaching identification of basic equipment used in forestry.	3.93	0.82
Teaching concepts in measuring forest products.	3.82	0.84
Teaching identification of forest pests.	3.78	0.90
Teaching management of forest pests.	3.72	0.92

Note. n = 171; M^I =Importance (1=Not important, 2=Of little Importance, 3=Somewhat important, 4=Important, 5=Very Important); Cronbach's α^I = .919.

The perceived importance of wildlife management concepts under the Basic Agriscience and Technology course Standard 10: Demonstrate basic skills in natural resource management is depicted in Table 5. Within this construct the top three reported items of perceived importance included "Teaching about careers in the wildlife management industry" (M = 4.27), "Teaching the definition of wildlife" (M = 4.26), and "Teaching identification of important species of wildlife in Georgia" (M = 4.19).

Table 5

Perceived Importance of Wildlife Management Concepts

Question Variables	M^I	*SD*
Wildlife Management Construct	4.00	0.81
Teaching about careers in the wildlife management industry.	4.27	0.72
Teaching the definition of wildlife.	4.26	0.70
Teaching identification of important species of wildlife in Georgia.	4.19	0.73
Teaching the difference between game and non-game species.	4.14	0.77
Teaching strategies in managing wildlife.	3.98	0.83
Teaching skills in vertical farming.	3.52	0.96
Teaching skills in aquaculture.	3.51	0.94

Note. n = 171; M^I=Importance (1=Not important, 2=Of little Importance, 3=Somewhat important, 4=Important, 5=Very Important); Cronbach's α^I = .915.

Teachers were asked to rate 26 items based on the Basic Agriscience and Technology curriculum standard using the Likert-type scales described in the methods section based upon Borich's Needs Assessment Model. Borich's (1980) needs assessment model was mainly intended to measure the level of competence individuals had upon completion of some form of training program, but in this case the Borich competence scale can be assessed in order to plan professional development opportunities where needed,

The perceived competence of natural resource concepts under the Basic Agriscience and Technology course Standard 6: Describe soil formation and management and assess its relevance to plant/animal production and natural resources management is described in Table 6. The top three reported items of perceived competence in the natural resources construct were "Teaching soil components" (M = 3.87), "Teaching concepts in soil erosion" (M = 3.82), and "Teaching concepts in soil texture" (M = 3.81).

Table 6

Perceived Competence of Natural Resource Management Concepts

Question Variables	M^C	*SD*
Natural Resources Construct	3.57	0.96
Teaching soil components.	3.87	0.83
Teaching concepts in soil erosion.	3.82	0.85
Teaching concepts in soil texture.	3.81	0.87
Teaching about careers in the Natural Resources industry.	3.74	0.93
Teaching concepts in soil formation.	3.66	0.82
Teaching concepts within soil ecosystems.	3.53	0.89
Teaching concepts in slope.	3.26	1.14
Teaching concepts in selecting appropriate soil management practices for a given land class.	3.12	1.17
Teaching how to determine land class on a given site.	3.09	1.17

Note. n = 171; M^C=Competence (1=Not competent, 2=Little competence, 3=Somewhat competent, 4=Competent, 5=Very competent); Cronbach's α^C = .927.

The perceived competence of forest science concepts within Basic Agriscience and Technology course Standard 10: Demonstrate basic skills in natural resource management is shown in Table 7. The top three reported items of perceived competence in the forest science construct were "Teaching about tree functions" (*M* = 3.93), "Teaching about careers in the forestry industry" (*M* = 3.80), and "Teaching identification of basic equipment used in forestry" (*M* = 3.67).

Table 7

Perceived Competence of Forest Science Concepts

Question Variables	M^C	*SD*
Forest Science Construct	3.55	1.01
Teaching about tree functions.	3.93	0.83
Teaching about careers in the forestry industry.	3.80	0.89
Teaching identification of basic equipment used in forestry.	3.67	1.05
Teaching identification of important species of trees in Georgia.	3.60	0.99
Teaching concepts in measuring forest products.	3.40	1.09
Teaching identification of forest pests.	3.16	1.12
Teaching management of forest pests.	3.05	1.12

Note. *n* = 171; M^C=Competence (1=Not competent, 2=Little competence, 3=Somewhat competent, 4=Competent, 5=Very competent); Cronbach's α^C = .944.

The perceived competence of wildlife management concepts under the Basic Agriscience and Technology course Standard 10: Demonstrate basic skills in natural resource management is described in Table 8. Within this construct the top three reported items of perceived competence included "Teaching the definition of wildlife" (*M* = 3.97), "Teaching the difference between game and non-game species" (*M* = 3.89), and "Teaching identification of important species of wildlife in Georgia/ Teaching about careers in the wildlife management industry (*M* = 3.74)."

Table 8

Perceived Competence of Wildlife Management Concepts

Question Variables	M^C	*SD*
Wildlife Management Construct	3.55	0.98
Teaching the definition of wildlife.	3.97	0.81
Teaching the difference between game and non-game species.	3.89	0.89
Teaching identification of important species of wildlife in Georgia.	3.74	0.94
Teaching about careers in the wildlife management industry.	3.74	0.90
Teaching strategies in managing wildlife.	3.44	1.01
Teaching skills in aquaculture.	2.94	1.15
Teaching skills in vertical farming.	2.92	1.17

Note. n = 171; M^C=Competence (1=Not competent, 2=Little competence, 3=Somewhat competent, 4=Competent, 5=Very competent); Cronbach's α^C = .928.

Mean Weighted Discrepancy Scores

Mean Weighted Discrepancy Scores were calculated using different personal characteristics of respondents and compared using different analyses. Georgia high school SBAE teachers identified items within each construct area. Items were combined in Table 9 to show the greatest items of need as well as the lowest. Items of need with the highest *MWDS* were identified as "Teaching about careers in the Natural Resources industry" (*MWDS* = 2.53), "Teaching management of forest pests" (*MWDS* = 2.48), and "Teaching concepts in selecting appropriate soil management practices for a given land class" (*MWDS* = 2.45). Items with the lowest need according to *MWDS* were identified as "Teaching concepts in soil texture" (*MWDS* = 1.00), "Teaching identification of basic equipment used in forestry" (*MWDS* = 1.01), and "Teaching the difference between game and non-game species." (*MWDS* = 1.04).

Table 9

Forestry, Natural Resources, and Wildlife Management Needs by MWDS

Question Variables	Importance	Competence	*MWDS*
Teaching about careers in the Natural Resources industry.	4.32	3.74	2.53
Teaching management of forest pests.	3.72	3.05	2.48
Teaching concepts in selecting appropriate soil management practices for a given land class.	3.77	3.12	2.45
Teaching identification of forest pests.	3.78	3.16	2.35
Teaching about careers in the wildlife management industry.	4.27	3.74	2.25
Teaching identification of important species of trees in Georgia.	4.13	3.60	2.22
Teaching strategies in managing wildlife.	3.98	3.44	2.14
Teaching about careers in the forestry industry.	4.29	3.80	2.11
Teaching skills in vertical farming.	3.52	2.92	2.10
Teaching skills in aquaculture.	3.51	2.94	2.01
Teaching identification of important species of wildlife in Georgia.	4.19	3.74	1.89
Teaching concepts in soil erosion.	4.24	3.82	1.85
Teaching how to determine land class on a given site.	3.60	3.09	1.81
Teaching concepts in measuring forest products.	3.82	3.40	1.61
Teaching concepts in slope.	3.68	3.26	1.55
Teaching concepts within soil ecosystems.	3.89	3.53	1.39
Teaching the definition of wildlife.	4.26	3.97	1.25
Teaching about tree functions.	4.21	3.93	1.18
Teaching soil components.	4.14	3.87	1.14
Teaching concepts in soil formation.	3.95	3.66	1.13
Teaching the difference between game and non-game species.	4.14	3.89	1.04
Teaching identification of basic equipment used in forestry.	3.93	3.67	1.01
Teaching concepts in soil texture.	4.05	3.81	1.00

Note. n = 171; Importance (1=Not important, 2=Of little Importance, 3=Somewhat important, 4=Important, 5=Very Important); Competence (1=Not competent, 2=Little competence, 3=Somewhat competent, 4=Competent, 5=Very competent; *MWDS*=Mean Weighted Discrepancy Score (True limits range from –12 to 12); Cronbach's α^I = .956 and α^C = .962.

Items within the Borich analysis were put into construct areas based on standard and specific content. *MWDS* by construct area and *MWDS* ranking are shown in Table 10. Forest Science (*MWDS* = 1.85) was the highest *MWDS* ranked construct. The construct area that had the lowest *MWDS* was Natural Resource Management (*MWDS* = 1.65).

Table 10

Forestry/Natural Resource MWDS by Construct

Construct Area	*MWDS*
Forest Science	1.85
Wildlife Management	1.77
Natural Resource Management	1.65

Note. n = 171; *MWDS*=Mean Weighted Discrepancy Score (True limits range from –12 to 12).

A comparison between Georgia high school male and female agriculture teachers with all items in the forestry/natural resources constructs is depicted in Table 11. An independent samples t-test was used to compare these two groups. *MWDS* were significantly different when comparing males versus females ($t_{170} = 3.79$, $p < .001$). Females (*MWDS* = 2.71) tended to have higher training needs than males (*MWDS* = 1.04). Table 11 represents the t-test data between gender and natural resource management, forest science, and wildlife management constructs.

Table 11

T-Test Between Males and Females for Forestry/Natural Resources Construct

Construct Areas	*Mean* for Males	Male *SD*	*Mean* for Females	Female *SD*	T-Test Significance
Natural Resource Management	.929	2.760	2.594	2.995	.000***
Forest Science	1.151	3.168	2.778	3.534	.002**
Wildlife Management	1.054	3.196	2.768	3.517	.001**
ALL	1.045	2.704	2.713	3.033	.000***

Note. n for Males = 99; n for Females = 73; * $p < .05$**, $p < .01$,*** $p < .001$.

Years of teaching experience were grouped into five categories: 1-5 years, 6-10 years, 11-15 years, 16-20 year, and 20 years or more. Teachers with 1 to 5 years of teaching experience had the highest training needs in forestry/natural resources concepts based on MWDS. See Table 12 for descriptive results.

Table 12

MWDS Scores of Years of Experience Groups

Years of Experience	*n*	*MWDS*	*SD*
1-5 years	53	3.11	2.60
6-10 years	35	2.30	2.99
11-15 years	33	0.52	2.42
16-20 years	29	0.60	3.20
20 or more years	23	1.01	2.61

Note. *MWDS*=Mean Weighted Discrepancy Score (True limits range from –12 to 12).

A between-subjects ANOVA was conducted to determine if there was a statistically significant difference between groups. There was a significant difference between years of experience and *MWDS* from the forestry/natural items ($F_{4,168}$= 6.84, $p < .01$). See Table 13 for the descriptive results.

Table 13

Analysis of Variance between Forestry/Natural Resource MWDS and Years of Experience

Construct	*df*	*MS*	*F*	*Sig*	$\acute{\eta}^2$
Natural Resource Management					
Between Groups	4	32.841	3.999	.004**	.087
Within Groups	168	8.213			
Total	172				
Forest Science					
Between Groups	4	70.696	6.935	.000***	.142
Within Groups	168	10.194			
Total	172				
Wildlife Management					
Between Groups	4	58.210	5.478	.000***	.115
Within Groups	168	10.625			
Total	172				
ALL					
Between Groups	4	52.349	6.837	.000***	.140
Within Groups	168				
Total	172				

Note. Years of Experience groups consist of 1-5 years, 6-10 years, 11-15 years, 16-20 years, and 20 or more years; * $p < .05$**, $p < .01$, *** $p < .001$.

To understand whether statistically significant differences existed within years of teaching experience a Least Significant Difference (LSD) post hoc test was conducted at the .05 significance level. *MWDS* differed with an instructor's years of experience. There was a significant difference in *MWDS* between teachers with 1-5 years of experience and 11-15 years of experience ($p < .001$), between teachers with 1-5 years of experience and 16-20 years of experience ($p < .001$), between teachers with 1-5 years of experience and 20 or more years of experience ($p = .003$), between teachers with 6-10 years of experience and 11-15 years of experience ($p = .009$), and between teachers with 6-10 years of experience and 16-20 years of experience ($p = .016$). However, there was no significant difference between teachers having 1-5

years of experience and 6-10 years of experience (p = .180), between teachers with 6-10 years of experience and 20 or more years of experience (p = .084), between teachers with 11-15 years of experience and 16-20 years (p = .911), between teachers with 11-15 years of experience and 20 or more years of experience (p = .520), and between teachers with 16-20 years of experience and 20 or more years of experience (p = .600). As years of teaching experience among Georgia high school agriculture education teachers increased *MWDS* decreased. Teachers with 1-5 years of teaching experience showed the highest *MWDS* scores while teachers with 11-15 years of teaching experience displayed the lowest *MWDS.* Significant differences within years of experience groupings are seen in Table 14.

Table 14

Significance Comparison Between Years of Teaching Experience and MWDS

Teaching Experience	1-5 years	6-10 years	11-15 years	16-20 years	20 or more years
1-5 years	--	.180	.000***	.000***	.003**
6-10 years	.180	--	.009**	.016*	.084
11-15 years	.000***	.009**	--	.911	.520
16-20 years	.000***	.016*	.911	--	.600
20 or more years	.003**	.084	.520	.600	--

Note. *p < .05. **p < .01. *** p < .001

The regions of Georgia are broken down into North, Central and South. A between-subjects ANOVA was run to determine if there was a statistically significant difference between the three regions in Georgia. There was a significant difference between regions and *MWDS* from all forestry/natural items ($F_{2,170}$=4.91, p < .008). See Table 15 for the descriptive results and Table 16 for an analysis of variance between forestry/natural resource MWDS and Georgia Agriculture Education regions.

Table 15

MWDS Scores between Georgia Agriculture Education Region

Region	*n*	*MWDS*	*SD*
North	81	2.38	2.92
Central	44	1.74	2.96
South	48	0.72	2.74

Note. MWDS=Mean Weighted Discrepancy Score (True limits range from –12 to 12).

Table 16

Analysis of Variance between Forestry/Natural Resource MWDS and Region

Construct	*Df*	*MS*	*F*	*Sig*	$\acute{\eta}^2$
Natural Resource Management					
Between Groups	2	21.065	2.438	.090	.085
Within Groups	170	8.641			
Total	172				
Forest Science					
Between Groups	2	78.409	7.250	.001**	.158
Within Groups	170	10.815			
Total	172				
Wildlife Management					
Between Groups	2	34.771	3.034	.051	.096
Within Groups	170	11.461			
Total	172				
ALL					
Between Groups	2	41.401	4.981	.008**	.127
Within Groups	170	8.311			
Total	172				

Note. Regions consist of North, Central, and South; * $p < .05$**, $p < .01$.

To understand whether statistically significant differences existed between Georgia Agriculture Education Regions an LSD post hoc test was conducted at the .05 significance level. There was a significant difference in *MWDS* between the North and South regions of Georgia ($p < .01$). However, there was no significant difference between the North and Central region ($p =$

.248) or the Central and South region (p = .092). The North Region had a higher *MWDS (MWDS* = 2.38) than each of the other two regions with the South region of Georgia reporting the lowest *MWDS (MWDS* = 0.72). Significant differences within Georgia Agriculture Education regions are shown in Table 17.

Table 17

Significance Comparison Between Georgia Agriculture Education Region

Georgia Ag. Ed. Region	North	Central	South
North	--	.238	.002**
Central	.238	--	.092
South	.002**	.092	--

Note. *p < .05. **p < .01. *** p < .001

Community settings within Georgia were broken down into Rural, Urban, and Suburban. A between-subjects ANOVA was run to determine if there was a statistically significant difference between community settings that the teachers identified teaching. There was no significant difference between community settings and *MWDS* from all forestry/natural items ($F_{2,170}$=2.73, p > .05). See Table 18 and for descriptive results and Table 19 for ANOVA results.

Table 18

MWDS Comparison of Forestry/Natural Resources based on Community Setting

Region	*n*	*MWDS*	*SD*
Rural	116	1.39	2.88
Urban	18	2.62	3.01
Suburban	39	2.43	3.00

Note. *MWDS*=Mean Weighted Discrepancy Score (True limits range from –12 to 12).

Table 19

Analysis of Variance between Forestry/Natural Resource MWDS and Community Setting

Construct	*df*	*MS*	*F*	*Sig*
Natural Resource Management				
Between Groups	2	14.787	1.697	.186
Within Groups	170	8.715		
Total	172			
Forest Science				
Between Groups	2	33.178	2.924	.056
Within Groups	170	11.347		
Total	172			
Wildlife Management				
Between Groups	2	28.108	2.436	.091
Within Groups	170	11.539		
Total	172			
ALL				
Between Groups	2	23.307	2.734	.068
Within Groups	170	8.524		
Total	172			

Note. Community Settings consist of Rural, Suburban and Urban.

Respondents were asked if they had ever had any career experience beyond teaching within natural resource management, forestry, or wildlife management. They were also given a fourth choice which was “none of these.” Due to unequal sample sizes, responses were categorized into, 1- “Having career experience in natural resource management, forestry, and/or wildlife management,” and 2- “Not having any career experience in natural resource management, forestry, and/or wildlife management.” An independent samples t-test was run to explore the difference in *MWDS* and career experience. Levene’s test for equality of variances was not met ($F = 6.750$, $p = .010$). There was not a significant difference between having career experience and not having career experience with the *MWDS* ($t_{49.87} = 6.750$, $p = .225$). See Table 20 for descriptive results.

Table 20

T-Test Between Career Experience in Forestry/Natural Resources and MWDS

Construct Areas	*Mean* for Some Experience	Some Experience *SD*	*Mean* for No Experience	No Experience *SD*	Sig.
Natural Resource Management	1.162	1.767	1.934	2.981	.086
Forest Science	1.515	2.711	2.150	3.603	.319
Wildlife Management	1.720	2.693	2.082	3.420	.563
ALL	1.466	1.978	2.055	3.051	.225

Note. *n* for Some Career Experience = 25; *n* for No Career Experience = 126.

Participants of the survey were also asked if they had ever had any type of personal experience (hunting, educational class, etc.) beyond teaching within natural resource management, forestry, or wildlife management. They were also given a fourth choice which was "none of these." Due to low responses for certain groups responses were categorized into, 1- "having some type of personal experience in natural resource management, forestry, and/or wildlife management," and 2- "Not having any career experience in natural resource management, forestry, and/or wildlife management." An independent samples t-test was run to explore the difference in *MWDS* and personal experience. There was a significant difference between those teachers who had personal experience and those not having personal experience with the *MWDS* (t_{102} = -2.404, p = .018). See Table 21 for descriptive results.

Table 21

T-Test Between Personal Experience in Forestry/Natural Resources and MWDS

Construct Areas	*Mean* for Experience	Experience *SD*	*Mean* for No Experience	No Experience *SD*	Sig.
Natural Resource Management	2.088	2.837	2.765	2.964	.284
Forest Science	3.372	3.319	3.285	3.346	.009*
Wildlife Management	1.743	3.001	3.469	3.135	.011*
ALL	1.734	2.661	2.661	2.843	.018*

Note. *n* for having Personal Experience = 31; *n* for No Personal Experience = 73; * $p < .05$.

Chapter Summary

Chapter 4 presented the findings of the study based upon the three objectives that guided the study. The research objectives for the study were (1) Identify and describe the personal characteristics of high school agricultural education teachers in Georgia; (2) Describe the perceived level of instructor importance of the forestry and natural resources curriculum for high school agricultural education teachers; and (3) Describe the perceived level of instructor competence of the forestry and natural resources curriculum for high school agricultural education teachers. In addition to the previous three research objectives, Mean Weighted Discrepancy Scores (*MWDS*) were calculated and a variety of analyses were used to determine the differences in teaching characteristics and *MWDS*. The findings presented in this chapter provided a better understanding of the teachers' perceptions of the forestry/natural resources curriculum and its relationship to their competence in that subject matter. The findings further described these perceptions based upon teacher personal characteristics, specifically including gender, years of teaching experience, agricultural education region, and personal experience in the field. The findings reported in this chapter are further discussed in chapter 5, along with conclusions and recommendations.

CHAPTER V
CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

Introduction

The purpose of this study was to determine teacher perception of forestry/natural resources curriculum in an effort to investigate internal barriers that teachers may be experiencing when implementing those concepts. High school agricultural education provides students with information regarding the forestry/natural resources industry and prepares students for a lifetime of informed decisions. With the forestry/natural resources industry being one of the top agriculture industries in the state of Georgia, it is important that teachers offer quality instruction to their students. Smith (2011) mentions the need for our students to learn more about these resources in our current curriculum. Wellman (1987) reported that 31% of college-bound high school seniors knew nothing about forestry careers and only 1% considered themselves to be "well-informed" about forestry. Having an agriculturally literate society and more specifically forestry/natural resources literate instructors is vital to Georgia agricultural education. With less than 1% of the United States population involved in production agriculture and almost 90% of the population being two or three generations removed from involvement within agriculture, the United States is quickly approaching a time where an agriculturally literate society is almost non-existent (Leising & Zilbert, 1994).

While agriculture education has grown and evolved in Georgia in the past 10 years, there is still a need for a more educated agriculture instructor. There is little research regarding the factors or barriers that agriculture instructors encounter when implementing forestry/natural resources concepts. This requires an assessment of instructor challenges to determine if students are receiving the instruction they need and if that curriculum is changing to meet student needs and warranted this study.

Summary of the Study

This study was designed to determine if Georgia high school educators were experiencing barriers to curriculum implementation by determining the perceived importance and competence of forestry/natural resource concepts. The AAAE National Research Agenda for agricultural education as well as goals within the GVATA tactical plan served as a guide for the research objectives and methodology of the study. The GVATA (2019) outlined a goal of identifying the needs of new teachers (1-5 years) and mid-career teachers (7-15 years) in the 2019 Tactical Plan (p. 18). The GVATA Tactical Planning committee (2019) also indicated the need for more training within their professional development committee by stating the need to "evaluate professional development workshops needed for members and make recommendations considering industry advised changes in technical information" (p. 3). The AAAE outlines the need for discovering "what methods, models, and practices are most effective in diffusing innovations" (Roberts et al., 2016, p. 6). Within research priority five, the AAAE also poses the question "what evaluation methods, models, and practices are effective in determining the impacts of educational programs in agriculture and natural resources" (Roberts et al., 2016, p. 6).

The following research objectives provided direction for the study:

1. Identify and describe the personal characteristics of high school agricultural education teachers in Georgia.
2. Describe the perceived level of importance of the forestry and natural resources curriculum for high school agricultural education teachers.
3. Describe the perceived level of instructor competence of the forestry and natural resources curriculum for high school agricultural education teachers.

These research objectives allowed direction for the data to be obtained. This helped gain a better understanding of where instructors are facing challenges when implementing forestry/natural resources curriculum. The findings of this study will also help guide professional development opportunities implemented by state and university staff.

Georgia agriculture education programs are designed to offer a variety of pathways for schools to choose from. The creation and implementation of career pathways is a national trend in Career, Technical and Agriculture Education (CTAE). There are six primary categories of agriculture pathways that Georgia schools may choose from for their school: animal science, forestry/natural resources, plant science/horticulture, agricultural mechanics, food science, and diversified agriculture (Georgia Department of Education, 2020). It is important to implement pathways that will gain the interest of the student while at the same time acknowledge the agriculture industry that may be present in the local community. Every high school agricultural instructor in the state of Georgia is required to teach a variety of concepts within the Basic Agriscience and Technology Course standards. There are three standards that focus on forestry/natural resource concepts. Questions from the objectives of those standards were ultimately used to develop the survey instrument.

The population for this descriptive study included all secondary agriscience teachers in Georgia (N = 358) that represent various demographical regions, economies, and socioeconomic status. A pilot study was conducted that included 15 secondary agriscience teachers in Georgia which were representative of the population being investigated. Participants of the pilot study were taken out of the population yielding a sample population of 343 teachers ($N = 343$). Participants within this study completed a two-part questionnaire designed and conducted through Qualtrics. The instrument was designed using influences from Clemons et al. (2018),

Duncan et al. (2006), and the Borich's Needs Assessment Model (1980). The Borich scale within the instrument consisted of 26 items that were based on concepts within three subject standards of the Basic Agriscience and Technology Georgia Performance Standards (natural resource management, forest science, and wildlife management). Respondents were asked to give their perceived importance on one side of each question and perceived competence on the other side of that same item. Upon conclusion of the survey, partially completed responses were taken out, yielding a total sample of 173 secondary agriculture teachers (n = 173). Results from the study were broken down into Mean Weighted Discrepancy Scores (*MWDS*) and various personal characteristics such as age, years of experience, gender, teaching backgrounds, and ethnicity.

Discussion and Conclusions

Teacher perceptions of the high school forestry/natural resources curriculum/experiences yielded the following conclusions:

1. There is a significant number of Georgia teachers that do not teach a forestry/natural resource pathway.
2. Georgia high school agriculture educators lack ethnic diversity.
3. Teaching about careers in the natural resources, forestry, and wildlife management industry was perceived to be the most important concept within all three constructs.
4. Teachers perceived they were most competent in teaching the definition of wildlife and teaching about tree functions.
5. Teachers with 1 to 5 years of teaching experience had the highest training needs in forestry/natural resources based on *MWDS*.
6. Teachers with no personal experiences in forestry, natural resources, and/or wildlife management had a significant need for training within those concepts.

Objective One Conclusions

Objective 1: Identify and describe the personal characteristics of high school agricultural education teachers in Georgia.

There is a significant number of teachers that do not teach a forestry/natural resource pathway. Among respondents there was a large number of instructors that reported they were not currently teaching a forestry/natural resources pathway (n = 132). Agriculture Education Pathways are designed to generate student interest within specific agriculture careers while at the same time give students specific knowledge and skills to prepare them for employment within that specific area. There are several options as to which pathway schools choose to implement. Those options along with other internal and external barriers give schools many factors to consider. Approximately 24% (n = 41) of teachers indicated they were currently teaching a forestry/wildlife pathway. This percentage coupled the large majority of teachers (n = 126) in the sample that have no career experience in the natural resources, forestry, or wildlife management field could be possible barriers to implementing forestry/natural resources curriculum.

Proper planning could also aid in the confidence for teachers with less than 5 years teaching experience. Josiah (2001) mentions that planning is a vital step in gaining the respect and interest of agriculture students (Josiah, 2001). Langley et al. (2014) recommends that teacher educators find strategies to prepare apprentice teachers for the move to new communities. An assortment of field experiences and purposeful assignments in student teaching allows students to experience a different culture other than their own. This also aids in discussions helping teachers dissect why certain techniques may have worked in their home and communities and others did not. These opportunities and discussions could also garner interest in a subject that students previously may not have considered.

Georgia high school agriculture educators lack ethnic diversity. Out of 173 participants, there were only nine respondents that reported an ethnicity other than Caucasian/White (Hispanic or Latino = 2, Black or African American = 7). This result reinforces Kantrovich's (2007) findings in that 88% of all agriculture educators across the United States are Caucasian/White. As Georgia strives to incorporate agriculture into more areas with differing ethnicities, it will be important to recruit a more diverse group of agriculture teachers. The same can be inferred when addressing community setting in which instructors are teaching. The majority of respondents reported teaching in a more rural setting (n = 116) while urban and suburban instructors made up 18 (n_u = 18) and 39 (n_s = 39) respectively. This is a demographic that needs to change for Georgia agriculture education to move into more urban communities such as Gwinnett, Dekalb, Clayton, and Fulton counties.

Objective Two Conclusions

Objective 2: Describe the perceived level of importance of the forestry and natural resources curriculum for high school agricultural education teachers.

Teaching about careers in the natural resources, forestry, and wildlife management industry was perceived to be the most important concept within each of the three constructs. The means for perceived importance are essential because they contribute to the overall *MWDS* and the conclusions regarding forestry/natural resources curriculum needs. Overall, teachers within the study had relatively high views of importance of forestry/natural resource related concepts labeling all of them "somewhat important" or greater. Perceived importance of forestry/natural resources concepts could play a large role on implementation of the concepts that are taught to students, which in turn could affect the level of student competence. The need for professional development in this instance aligns with the adult learning theory that specifies that

adults have a higher level of motivation to learn what they perceive as important (Layfield & Dobbins, 2002).

Instructors should also utilize forestry professionals and others involved in the field to promote the profession. Jabbour and Pellissier (2019) note that support teachers mentioned most frequently as beneficial within their study were guest speakers, followed by co-teaching or having a teaching assistant and having connections with farmers or producers.

Teachers could involve various individuals working in these careers by school visits and providing information about that particular industry. This would not only open student's perspectives but give instructors an improved sense of importance. Local chapters of professional organizations, government agencies, forest products businesses, college forestry departments, and other groups could develop outreach programs and partnerships through which they support local schools in their area. These groups should be open and willing to meet teacher desires and needs with regard to teaching about forestry, natural resources, and wildlife management concepts.

Concepts with lower importance means should also be evaluated to determine true teacher value. Strategies to assist teachers in understanding the importance and value of forestry/natural resource-related concepts should be developed along with the rationale for incorporating them into the curriculum. Increased education and marketing of the forestry profession at the high school level will improve understanding of the field and profession (Sharik & Frisk, 2011). Schlosser (1988) detailed the importance of recruitment and retention of forestry students and points out that efforts should be taken to make sure high school students in particular are aware of the forestry profession because this is when many students make career

choices. Students that are more aware of careers and opportunities will help promote forestry education as well as a more informed forestry workforce.

Objective Three Conclusions

Objective 3: Describe the perceived level of instructor competence of the forestry and natural resources curriculum for high school agricultural education teachers.

Teachers perceived they were most competent in teaching the definition of wildlife, and teaching about tree functions. Teachers were asked to indicate their perceived level of competence for concepts within forestry/natural resources. Overall, teachers within the study had a lower competence level than the level of perceived importance of forestry/natural resource-related concepts. There were some concepts within the study that had means below "somewhat competent." The highest levels of competence included the instructor's perceived ability to teach the definition of wildlife and teach about tree functions. The means for perceived competence are important because they contribute to the overall *MWDS* and the conclusions regarding forestry/natural resources curriculum needs. Concepts that involved more of a problem-solving approach had lower mean values such as teaching how to determine land class on a given site, teaching management of forest pests, and teaching skills in vertical farming and aquaculture. However, more basic concepts such as defining or labeling tended to have higher competency scores. Friend (2008) found similar results when examining the frequency of forestry techniques and skills being presented by teachers. Calculating timber volume, pacing to determine a linear distance, measuring standing trees, and identifying tree species by leaves were most often presented. Topics taught least included chainsaw maintenance techniques, identification of forest fire fighting tools, professional and technical employment in forestry, and identifying potential den and mast trees. The need for professional development aligns with the adult learning theory

that specifies that adults have a higher level of motivation to learn what they perceive as important (Layfield & Dobbins, 2002).

MWDS Conclusions

Technical content need is represented by the *MWDS*. The highest rated content training need was teaching about careers in the natural resources industry, followed by teaching management of forest pests, and teaching concepts in selecting appropriate soil management practices for a given land class.

Teachers with 1 to 5 years of teaching experience had the highest training needs in forestry/natural resources based on *MWDS*. Teachers with 1 to 5 years teaching experience represented the largest group of respondents with participation dropping slightly among groups with more years of experience. This aligns with a Tippens et al. (2013) finding that almost 50% of agricultural educators leave the profession within the first 5 years. For data analysis purposes, teachers with more than 20 years were grouped together. There was a statistically significant difference between the *MWDS* of several of the year range groupings. Teachers that had more years of experience had the greatest discrepancy between perceived importance and perceived competence. As years of experience increased among each group, there was a decline in training needs for those teachers with the exception of teachers with 20 or more years of teaching experience. In that instance, MWDS and the need for training rose slightly. The most significant decline in *MWDS* was between 6 to 10 years and 11 to 15 years of experience. The number of high school agricultural education positions on the rise in Georgia yields an increasing number of inexperienced agriculture teachers in the state. Professional development should continue to be developed and implemented to assist new teachers in obtaining the knowledge and skills needed to teach these concepts.

Teachers with no personal experiences in forestry, natural resources, and/or wildlife management had a significant need for training within those concepts. Teachers were asked to indicate if they had any previous personal experience within forestry, natural resources, and/or wildlife management. This could include but is not limited to experiences with community setting growing up, hunting, fishing, internships, educational background, job shadowing, etc. Group responses were categorized into, 1- "having some type of personal experience in natural resource management, forestry, and/or wildlife management," and 2- "Not having any career experience in natural resource management, forestry, and/or wildlife management." There was a significant difference in *MWDS* between teachers that indicated having personal experience in one of those three areas and those that did not have any personal experiences. Teachers that indicated having no personal experience had a significant need for training within forestry/natural resources concepts. These results align with Groves (1977) who studied variables related to a teacher's knowledge and opinion of natural resources as well as their methods for teaching a forestry unit. Results from this study showed that graduate school type, area of study, type of community lived in as a youth, and type of undergraduate school related to their natural resource knowledge. Teacher opinions about natural resources were related to the number of conservation or outdoor recreational activities they participated in both at the time of study and during their youth. This also aligns with Lane and Wilkie (1994) and Sebasto (1998) who found limited backgrounds in environmental education was a main reason for low integration levels.

Recommendations

Teachers must be careful not to overemphasize one subject within an introductory agriculture course at the expense of another. It is important that a teacher wishing to implement forestry and natural resource curriculum structure his or her class to create student interest.

Recommendations for Practice

Josiah (2001) analyzed 168 non-governmental organizations from 42 developing countries that implemented expansion programs for natural resources and found three organizational structures: (1) including the use of partnerships, (2) networks, (3) and intermediary arrangements (Josiah, 2001). Learning from each other and building connections are vital in order to build knowledge in the area of forestry and natural resources whether it be for an extension agent or a high school agriculture teacher. Partnerships between the instructor and members of the community also need to be developed in order to facilitate "real world" experiences and provide the instructor with more avenues to learn about those concepts. Project Learning Tree is one example of a well-known program that provides teachers with information about forestry education and suggests ways that activities can be used to meet mandated standards thereby mitigating the challenges faced by them. Instructors should also utilize industry professionals and others involved in the field of forestry/natural resources to promote the profession. Teachers could involve various individuals working in these careers by school visits and providing information about that particular industry. Local chapters of professional organizations, government agencies, forest products businesses, college forestry departments, and other groups could develop outreach programs and partnerships through which they support local schools in their area. These groups should be open and willing to meet teacher desires and needs with regard to teaching about forestry, natural resources, and wildlife management concepts.

An agriculture instructor must also be well versed in providing students with these hands-on experiences. It is through visualizing important concepts and facts that students can build knowledge bases. Miles (1994) describes visualizing as "creating mental pictures to aid in

learning, thinking, and solving" (p. 50). Without these visualizations through hands-on experiences, these barriers are very difficult to overcome. Hyerle (1996) notes that when concepts are organized and visual, students can begin to sharpen their abilities to communicate the information. When teachers oppose the traditional method of lecturing in secondary classrooms and integrate visualizing into the class on a regular basis, they have penetrated barriers to learning (Freseman, 1990). Linking students to hands-on experiences within natural resources is an important factor in being a confident and effective teacher. Traditionally it has been important to incorporate aspects such as demonstration areas within forestry, wildlife, and natural resource education (Clapp, 1951). In Barlow's (2012) study of 30 undergraduate students, there were several correlations that can be found when preparing forestry, wildlife, and natural resources extension specialist in implementing experiential learning. A majority of the students said they preferred outdoor and participative learning such as outdoor lectures. By incorporating these concepts into the curriculum agriculture educators begin to seek new knowledge and professional development. Making sure teachers are supplied with the resources (and more importantly the knowledge of how to use demonstration areas) will benefit teachers by gaining student interaction, interest, and pride.

Recommendations for Recruitment

Developing interest within the subject matter involves the teachers knowing how to design the curriculum. The process of designing the curriculum allows the teacher to develop expertise in a new area, or perhaps in one that he or she may already have pursued as an avocation (Kelleher, 1998). Proper planning is essential in not only being prepared but also encouraging instructors to learn more about what they are teaching. Johnson (2006) describes

that once proper planning has taken place, an instructor is more prepared and can easily catch the interest of his or her students.

Efforts to seek out individuals that have experience and/or knowledge of the forestry/natural resources field would be beneficial in filling the void of content inexperience seen from these results. With almost 50% of agricultural educators leaving the profession within the first 5 years and an agriculture teacher shortage, this may aid in filling teaching positions that Georgia desperately needs (Tippens et al., 2013, Thompson, 2013). Marketing agriculture education as more than just that would be one strategy university faculty could pursue. Many high school and college students are unaware of agriculture jobs available, let alone agriculture education jobs. Each year the agriculture industry adds nearly 60,000 jobs, but only 3% of high school and college students are aware of those jobs (NAFB, 2016). Advertising agriculture education to colleges within a university may find individuals that have the knowledge base and would be more interested in teaching subjects such as forestry, natural resources management, or wildlife management. Furthermore, finding students within the college of education at respective universities that may be interested in teaching an alternative to a science-based course could be another possibility in finding qualified forestry/natural resources teachers.

Recommendations for Teacher Preparation and Professional Development

Forestry education proponents should support current programs and develop additional forestry training and/or professional development opportunities for teachers as suggested in other studies (Lane & Wilke, 1994; Sebasto, 1998). Georgia agriculture teachers indicated the need for professional development based on forestry/natural resources concepts embedded within the introductory level course required for every agriculture pathway (Basic Agriscience and Technology). The findings in this study support the need for professional development by state

staff and university faculty. Duncan et al. (2006) found similar trends in the professional development needs of agriscience teachers in Georgia. Georgia state staff and university faculty should modify curricula to include more integration of content specific material for pre-service and in-service agriculture teachers.

At each university teachers learn about teaching pedagogy, but may also choose certain electives that will aid in their content knowledge within each respective agricultural field. The findings within this study indicated a number of concepts within forestry/natural resources that could also be addressed through class opportunities at respective universities. Teachers indicated teaching about careers in the natural resources industry, teaching management of forest pests, teaching concepts in selecting appropriate soil management practices for a given land class as some of the more dominant concepts. These concepts along with several others should be addressed in university teacher preparation curricula in Georgia as well. Agriculture education programs within universities could require more content specific courses and/or implement some type of content specific certification that students are required or encouraged to complete before graduation. Georgia state staff can also increase professional development opportunities in this area for current agriculture teachers, as well as update their existing curriculum resources.

Future Research

While this study sought to look at perceptions of Georgia agriculture educators, it is also recommended that other states examine their current pre-service and in-service training to determine if this need is present in their states.

This nature of this study includes a quantitative approach and has some possible limitations. While using a web-based survey instrument does provide an easy way of disseminating and collecting responses, it is a rigid instrument in which the participants cannot

give feedback outside the parameters of the instrument used. Future research could involve a mixed-methods approach where teachers are put into focus groups depending on teaching experience, gender, geographic location, and areas of expertise and asked questions regarding barriers to teaching forestry/natural resources that they have experienced. Furthermore, this approach could also clarify how much time is spent teaching different areas of Georgia agriculture standards. This would help further clarify potential barriers and open the door to future research and/or solutions. Examining how the current data relates to the teachers' personal and demographic characteristics could also provide more insight as to what factors may affect curriculum implementation.

This study sought to look at the internal factors that may cause teachers to implement forestry/natural resources curriculum. Future studies could also look at the external barriers that cause curriculum and/or pathway choices at particular schools. Investigation of those results along with additional assessments of some type of content certification program may provide a better understanding of the need and usefulness of such programs. Possible external barriers may include community setting, school pathway choice, or resources available. There can be added challenges to the instructor when taking students to outdoor areas. Simmons (1998) noted six benefit and barrier factors to teaching outdoors: appropriateness of teaching setting, teacher confidence, worries, need for training, hazards, and difficulty of teaching environmental education. Deep woods and rivers, ponds, and marshes settings were seen as significantly more appropriate for teaching natural resources than urban nature was, but they were also seen as presenting significantly more hazards than county park and urban nature settings. It may be necessary to study these challenges in an effort to reduce barriers to curriculum implementation.

This research study concentrated on forestry/natural resources concepts based on the introductory course for all pathways (Basic Agriscience and Technology). Examining the three other major program areas (Agriculture Mechanics, Animal Science, and Horticulture) may also benefit state staff and university faculty in implementing programs and/or professional development opportunities.

Chapter Summary

Selecting an agriculture pathway has become an important factor within the success of high school agriculture education curriculum. Those working in the forestry and natural resources field conserve and manage our forests and natural resources. The value of this industry in Georgia can be seen from the very beginning of the colony's establishment. Having a forestry/natural resources literate society is vital in Georgia agricultural education. While agriculture education has grown and evolved in Georgia in the past 10 years, there is still a need for a more educated agriculture instructor. This requires a consistent assessment of instructor challenges to determine if students are receiving the instruction they need and if the curriculum is changing to meet student needs.

The study was designed to determine if Georgia high school educators were experiencing barriers to curriculum implementation by determining the importance and competence of forestry/natural resource concepts. The significance of the study is further justified by the AAAE national research agenda. The study assists in the solution to research priority number five which is "what methods, models, and practices are most effective in diffusing innovations" and "what evaluation methods, models, and practices are effective in determining the impacts of educational programs in agriculture and natural resources (Roberts et al., 2016)." Additional justification from the GVATA (2019) seeks to "evaluate professional development workshops

needed for members and make recommendations considering industry advised changes in technical information (p. 3)."

The findings of the study yielded descriptive data that explains particular weaknesses in the importance and competence of forestry/natural resources curriculum. The data further shows the discrepancy of perceived teacher importance and perceived teacher competence. Analysis of the data resulted in conclusions that were further discussed and recommendations established for teacher practice, recruitment, professional development, and future research. The themes within these recommendations included professional development related to content specific items, curriculum development, and high school agriculture education experiences (partnerships, stakeholder groups, proper planning, and lesson development).

An agricultural instructor has to deal with a variety of different barriers that can greatly affect the nature in which the students learn (Johnson, 2007). Unique and engaging pedagogical approaches are crucial for supporting effective learning opportunities effective to meet the needs of today's learners (McKendree et al., 2019). The forest industry is the second largest industry in Georgia providing 118,423 jobs and injecting $27.2 billion into the state's economy (Georgia Forestry Commission, 2019). As the forestry and natural resources industries grow, there will be a need for skilled instructors to prepare our students for this industry after high school. It is important that we as agriculture professionals advocate for agriculture literacy within the content as well as a whole.

References

Armstrong, Patricia. (2019). Bloom's taxonomy. Center for teaching: Vanderbilt University. Retrieved from: https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy

Ary, D., Jacobs, L. C., & Sorensen, C. (2010). *Introduction to research in education.* (8th ed.). Cengage Learning.

Ashraf, E., Sarwar, A, Junaid, M., Baig, M., Shurjeel, H., & Barrick, R. (2020). An assessment if in-service training needs for agricultural extension field staff in the scenario of climate change using borich needs assessment model. *Sarhad Journal of Agriculture, 36*(2), 427-446.

Bandura, A. (1994) Self-efficacy. *Encyclopedia of psychology* (New York, Wiley), 368–369.

Barlow, R. J. (2012). Natural resource service learning to link students, communities, and the land. J*ournal of Extension*. *50*(5): 5IAW3.

Bartlett, J. E., Kotrlik, J. W., & Higgins, C. C. (2001). Organizational research: Determining appropriate sample size in survey research. *Journal of Information Technology, Learning, and Performance, 19*(1), 43-50.

Bettis, J. L., Tackie, D. O., & McElhenney, W. H. (2017). Factors which influence African Americans' decisions to choose the forestry/natural resources management professions: the Tuskegee university case. *NACTA Journal, 61*(3): *248-254.*

Borich, G. D. (1980). A needs assessment model for conducting follow-up studies. *Journal of Teacher Education, 31*(3*),* 39-42.

Bowyer, J. L. (2000). Uncovering the story. *Forest Products Journal 50* (2):10.

Burton, D. B. (2012). *Introduction to forestry science (*3rd ed*)*. Cengage Learning.

Camp, W. G. (1987). Smith, Hughes, Page, and Prosser. *The Agricultural Education Magazine, 59(8),* 5-7.

Clapp, E. H. (1951). Education and demonstration in American forestry. *Journal of Politics. 13*(3), 345-368. Retrieved from: http://www.jstor.org/stable/2126155

Clemmons, C. A., Heidenreich, A. E., & Lindner, J. R. (2018). Assessing the technical expertise and content needs of Alabama agriscience teachers. *Journal of Agricultural Education, 59*(3), *87-99.* doi.org/10.5032/jae.2018.03087

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). Wiley.

Cohen, A. M. 2011. The gamification of education. *Futurist 45:*16–17.

Copenheaver, C.A., Duncan, D.W., Leslie, L.D., McGehee, N.G. (2004). An exploration of cross-disciplinary peer education in natural resources. *Journal of Natural Resources:* 33, 124-130.

Dailey, A. L., Conroy, C. A., & Shelley- Tolbert, C. A. (2001). Using agricultural education as the context to teach life skills. *Journal of Agricultural Education, 42(*1*),* 10-19. doi: 10.5032/jae.2001.01010

Dana, S., & Johnson, E. (1963). *Forestry Education in America Today and Tomorrow*. Society of American Foresters.

Davenport, E. (1908). The next step in agricultural education or the place of agriculture in our American system of education. Urbana: University of Illinois. Retrieved from: https://babel.hathitrust.org/cgi/pt?id=uc2.ark:/13960/t7gq6tg18&view=1up&seq=3

Deal, K. H. (2016). *Wildlife and natural resource management*. Stamford, CT: Cengage Learning.

DeLuca, S., Plank, S., & Estacion, A. (2006). *Does career and technical education affect college enrollment?* Columbus, OH: National Dissemination Center for Career and Technical Education. Retrieved from: https://files.eric.ed.gov/fulltext/ED497349.pdf

DeVellis, R. (2003). *Scale development: Theory and applications.* Russell Sage Foundation.

Dillman, D., Smyth, J., Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. Wiley.

Dobbins, T., & Camp, W. (2003). Clinical experiences for agricultural teacher education programs in North Carolina, South Carolina, and Virginia. *Journal of Agricultural Education, 44(4),* 11-21. doi: 10.5032/jae.2003.04011

Dooley, K. E. (1999). Towards a holistic model for the diffusion of educational technologies: An integrative review of educational innovation studies. *Educational Technology & Society 2(4),* 35-45.

Duncan, D. W., Ricketts, J. C., & Peake, J. (2006). Teacher preparation and inservice needs of Georgia agriculture teachers. *Journal of Agricultural Education*, *47*(2), 24-35. doi: 10.5032/jae.2006.02024

Egan, M. M. (1988). My chance: Broadening horizons for forestry students. *Journal of Forestry 86(7):* C3.

Farrow, S. M. (2012). *Forestry education attitudes and teaching practices among high school science teachers in the southern piedmont*, Virginia Polytechnic Institute. Semantic Scholar. Retrieved from: https://pdfs.semanticscholar.org/b148/5ad2d8a6c3027fa34e09b81cda5059e0e1b9.pdf?_ga=2.145127228.903674880.1595010563-145438831.1595010563

Fink, A. (1995). *The survey handbook*. Sage Publications.

Fowler, S. M. (2012). *Forestry education attitudes and teaching practices among high school science teachers in the southern piedmont* [Master's thesis, Virginia Polytechnic Institute and State University]. Virginia Tech Digital Archive. Retrieved from: http://hdl.handle.net/10919/42584

Fraenkel, J. R., Wallen, N. E., & Hyun, H. (2012). *How to design and evaluate research in education*. 8th Edition. Boston, MA: McGraw-Hill.

Freseman, R. D. (1990). Improving higher order thinking of middle school geography students by teaching skills directly. ERIC Document Reproduction Service, ED 20842.

Friedel, J. N. (2011). Where has vocational education gone. *American Educational History Journal, 38*(1), 37-53.

Friend, K. R. (2008). *Attitudes and knowledge of forestry by high school agricultural education teachers in West Virginia.* [Master's Thesis, West Virginia University]. Research Repository.

Garton, B. L., & Chung, N. (1996). The in-service needs of beginning teachers of agriculture as perceived by beginning teachers, teacher educators, and state supervisors. *Journal of Agricultural Education, 37*(3), 52-58.

Georgia Agriculture Education. (2019). *Georgia agricultural education annual report.* Retrieved from: https://www.georgiaffa.org/docs/97246_2017-2018%20Georgia%20Ag%20Ed%20Annual%20Report.pdf

Georgia Forestry Commission. (2010). Georgia forest facts. Retrieved from: https://gfagrow.org/wp-content/uploads/2014/12/GeorgiaForestFacts.pdf

Georgia Department of Education. (2020). Georgia-pathway-documents. Retrieved from: https://www.gadoe.org/Curriculum-Instruction-and-Assessment/CTAE/Pages/Georgia-Pathway-Documents.aspx

Georgia Teaching Certification. (2011-2020). Retrieved from: http://www.teaching-certification.com/georgia-teaching-certification.html#initial-cert

Georgia Vocational Agriculture Teachers' Association. (2019). Constitution and by-laws. Retrieved from: https://www.georgiaffa.org/docs/15478_GVATA%20Constitution%20and%20Bylaws%20-%20Revised%20Jan%202019%20.pdf

Goodnough, K., & Hung, W. (2009). Enhancing pedagogical content knowledge in elementary science. *Teaching Education, 20(3*), 229-242. Retrieved from: http://dx.doi.org/10.1080/10476210802578921

Greiman, B. C., Walker, W. D., & Birkenholz, R. J. (2002). The induction of novice teachers: A study of first-year agriculture teachers in Missouri. Proceedings of the 29th National Agricultural Research Conference. Retrieved from: http://aaaeonline.ifas.ufl.edu/NAERC/2002/naercfiles/NAERC/Induction%20Greiman-Walker-Birkenholz.pdf

Green, C. C. (2006). *Forestry education in the United States*. University of Washington Libraries. http://www.istl.org/46-supp/article7.html

Graves, H.S. & Guise, C.H. (1932). *Forest Education*. Yale University Press.

Groves, D. L., Cauley, V. B., & Smith, D. W. (1977). Some important variables related to teachers' natural resource knowledge and opinion and some of their strategies for teaching a forestry unit. *Journal of Instructional Psychology. 4*(4), pp. 32-39.

Hager S., Straka, T., & Irwin, H. 2007. What do teenagers think of environmental issues and natural resources management careers? *Journal of Forestry 105:* 95–98.

Hardner, A., & Lindner, J.R. (2008). County extension agents' perceptions of extension. *Journal of Extension, 46(3),* 3FEA2. Retrieved from http://www.joe.org/joe/2008june/a2.php.

Hartfield, K. N. (2011). *Perceived levels of teacher self-efficacy among secondary Arizona agricultural education teachers.* [Unpublished master's thesis]. University of Arizona.

Hebert, E., Lee, A., & Williamson, L. (1998). Teachers' and teacher education students' sense of efficacy: Quantitative and qualitative comparisons. *Journal of Research and Development in Education, 31:* 214-225.

Hillison, J. (1986). *Agricultural teacher education preceding the Smith-Hughes Act.* Virginia Plytechnic Institute and State University.

Holton, E., & Burnett, M. B. (1997). *Qualitative research methods*. Berrett-Kohler Publishers.

Hosmer, R. S. 1923. The progress of education in forestry in the United States. *Empire Forestry Journal 2* (1):83-106.

Hughes, G. D. (2012). Teacher retention: Teacher characteristics, organizational characteristics, and teacher efficacy. *The Journal of Educational Research, 105*(4), 245-255. doi: 10.1080/00220671.2011.584922

Hughes, M., & Barrick, R. K. (1993). A model of agriculture education in public schools. *Journal of Agricultural Education*, 34(3), 59-67. Doi:10.5032/jae.1993.03059

Hyerle, D. (1996). Visual tools for constructing knowledge. Alexandria, Va.: *Association for Supervision and Curriculum Development*.

Izlar, R. E. (2006). *The centennial history of forestry in Georgia: A pictorial journey*. Virginia Beach, VA: Donning Co. Publishers.

Joerger, R. M. (2002). A comparison of the in-service education needs of two cohorts of beginning Minnesota agricultural education teachers. *Journal of Agricultural Education, 43*(3), 11-24.

Johnson, Carla. (2006). Effective professional development and change in practice: Barriers science teachers encounter and implications for reform. *School of Science and Mathematics*. *106*(3): 150-161.

Josiah, J. H. (2001). Approaches to expand NGO natural resource conservation program outreach. *Society and Natural Resources 14*: 609-618.

Kane, R., & Russell, T. (2005). Reconstructing knowledge in action: Learning from the authority of experience as a first-year teacher. *Teacher Professional Development in Changing Conditions*. Netherlands: Springer.

Kantrovich, A. J. (2007). *A national study of the supply and demand for teachers of agricultural education from 2004–2006*. Morehead State University.

Kelleher, James. (1998). Breaking disciplinary barriers. *Education Week. 18*(10):50.

Kovach, Mary. (2018). A review of classical motivation theories: Understanding the value of locus of control in high education. *Journal of Interdisciplinary Studies in Education 7*(1), 34-53. doi: 10.5281/zenodo.1867447

Lambert, David K. (2017). Workforce education and technical change bias in U.S. agriculture and related industries. *American Journal of Agricultural Economics, 100*(1): 338-353. doi: 10.1093/ajae/aax047

Lane, J. & Wilke, R. (1994). Environmental education in Wisconsin: A teacher survey. *The Journal of Environmental Education 25* (4):9.

Langley, G. C., Martin, M., & Kitchel, T. (2014). Novice agriculture teachers' general self-efficacy and sense of community connectedness. *Journal of Agricultural Education, 55*(4), 1-11. doi: 10.5032/jae.2014.04001

Lavrakas, P. J. (2010). *Telephone Surveys.* In Handbook of Survey Research, 2nd eds., eds. Peter M. Marsden and James D. Wright, pp. 471–98. Emerald Group Publishing Ltd.

Layfield, K. D., & Dobbins, T. R. (2002). In-service needs and perceived competencies of South Carolina agricultural educators. *Journal of Agricultural Education, 43*(4), 45-65. doi: 10.5032/jae.2002.04046

Leedy, P. D. & Ormrod, J. E. (2010) *Practical Research: Planning and Design*, Ninth Edition. NYC: Merril.

Leising, J. G. & Zilbert, E. E. (1994). Validation of the California agricultural literacy framework. Proceedings of the National Agricultural Education Research Meeting, USA, 21, 112-119.

Lindner, J. & Wingenbach, G. (2002). Communicating the handling of nonresponse error in journal of extension research in brief articles. *Journal of Extension 40(6).* Retrieved from: https://www.joe.org/joe/2002december/rb1.php

Lindner, J., Murphy, T., & Briers, G. (2001). Handling of nonresponse in social science research. Journal of Agricultural Education *42*(4), 43-53. Doi: 10.5032/jae.2001.04043

Magee, B. (2001). *The Story of Philosophy* (1st Edition). DK Publishing.

Malpiedi, B. (1987) Agricultural education after Smith-Hughes: A decade of growth and definition. *The Agricultural Education Magazine, 59*(8), 11-13.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*, 370-396.

McKendree R., McKim, A., and Pauley, C. (2019). Games in natural sciences education: exploring the perspectives of secondary school educators. *Natural Sciences Education, 48*(1), 1-5

Mercier, S. (2015). *Food and agricultural education in the United States*. Agree.

Mertler, C. A. (2018). *Introduction to educational research* (2nd ed.). SAGE Publications.

Miles, C. (1994). The fourth "r": Practical thinking for the cautious teacher. *Journal of Developmental Education* 17(3): 50-51.

Mundt, J. P. (1991). The induction year: A naturalistic study of beginning teachers of agriculture in Idaho. *Journal of Agricultural Education, 32*(1), 18-23. doi:10.5032/jae.1991.01018

National Association of Agriculture Educators. (2020). *What is agriculture education?* NAAE website. Retrieved from: https://www.naae.org/whatisaged/index.cfm.

National Future Farmers of America. (2020). *Agricultural education*. Retrieved from: https://www.ffa.org/about/agricultural-education

Neck, C., Houghton, J., Murray, E., & Lattimer, C. (2017). *Management* (2nd ed.). Wiley.

Nuangchalerm, P. (2011). In-service science teachers' pedagogical content knowledge. *Studies in Sociology of Science, 2*(2), 33-37.

Perkins, R. A. (2011). *Using research-based practices to increase response rates of web-based surveys*. Boise State University Scholar Works. Retrieved from: https://scholarworks.boisestate.edu/cgi/viewcontent.cgi?referer=http://scholar.google.com/&httpsredir=1&article=1020&context=edtech_facpubs

Perry, G. (1998*). Results of the Oregon K-12 teacher survey on the content and use of agricultural and natural resource curriculum*. Oregon State University.

Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. L. (2008). *Handbook on agricultural education in the public schools.* Thomson Delmar Learning.

Pineda, H. J., Adams, E., & Hammett, A. L. (2018). Incorporating experiential teaching methods in sustainable natural resources curriculum: A case study. *Journal of Natural Resources and Life Sciences Education (40),* 167-176. doi: 10.4195/jnrlse.2010.0035u

Rane, F. W. (1906). Forestry in the Public Schools. *Journal of Education 64*(17): 472.

Ravid, R. (2011). *Practical Statistics for Educators*. 4th Ed. University Press of Americas, Inc.

Roberts, T. G., Harder, A., & Brashears, M.T. (Eds). (2016). *American Association for Agricultural Education national research agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.

Robinson, C. H., & Jenks, F. B. (1913). *Agricultural instruction in high schools.* U.S. Government Printing Office.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Rosenshine, B., & Furst, N. (1969). *The effects of tutoring upon pupil achievement: A research review*. ERIC documents

Rotter J. B. (1990). Internal Versus External Control of Reinforcement: A Case History of a Variable, *American Psychologist*, 45(4), 490-493.

Sample, V., Block, N., Ringgold, P., & Giltmier. (2000). *The Evolution of Forestry Education in the United States: Adapting to the Changing Demands of Professional Forestry*. Pinchot Institute for Conservation.

Schlosser, W.E. (1988). My chance: Getting the best students for the forestry profession. *Journal of Forestry 86(12)*: C3.

Sebasto, N., & Smith, J. (1998). Environmental education in the University of Illinois. *The Journal of Environmental Education 29* (2):21.

Sharik, T., Field, D., Force, J., Keathley, D., & Smith, C. (2004) Trends in undergraduate enrollment in natural resources at NAPFSC Institutions, 1980-2003. *Natural Resources and Environmental Issues, 12(*15).

Sharik, T. L., Frisk, S. L. (2011). Student perspectives on enrolling in undergraduate forestry degree programs in the United States. *Journal of Natural Resources & Life Sciences Education 40*: 160-166.

Sherman, T. M. & Giles, M. B. (1983). An analytic review of a process-product variable: teacher clarity. *Educational Research Quarterly, 8*(2), 26-37.

Sherry, L. & Gibson, D. (2002). The path to teacher leadership in educational technology. *Contemporary Issues in Technology and Teacher Education, 2*(2), *178-203*.

Sherry, L. (1997). The boulder valley internet project: Lessons learned. *Technological Horizons in Education Journal, 25*(2), 68-73.

Shoreline Community College. (2013). *Carl D. Perkins Vocational and Technical Education Act: 2003 Legislative Brief.*

Shulman, L. S. (1986) Those who understand: knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Simmons, Deborah. (1998). Using natural settings for environmental education: perceived benefits and barriers. *The Journal of Environmental Education*. *29*(3), 23-31.

Smith, B. O. (1971). Research in teacher education [Symposium]. Englewood Cliffs, NJ: Prentice Hall. ERIC Documents: ED049193.

Smith, D. W. (2011). Forest resources education and Virginia's standards of learning. *Virginia Forests LXVII* (3): 19-21.

Society of American Foresters. (n.d.). *Our History*. Retrieved from: https://www.eforester.org/Main/About/History/Main/About/History.aspx?hkey=f112ee86-0f07-4cca-b342-b9d4bca0f535

Spector, P. (1997). *Job Satisfaction: Application, Assessment, Causes and Consequences.* Sage.

Stern, M., Adams, A., & Elsasser, S. (2009). Digital inequality and place: the effects of technological diffusion on internet proficiency and usage across rural, suburban, and urban counties. *Sociological Inquiry*, *79*(4), 391-417.

Stripling, C., Ricketts, J. C. Roberts, T. G., & Harlin, J. F. (2008). Preservice agriculture education teachers' sense of teaching self–efficacy. *Journal of Agricultural Education, 49*(4), 120–130. doi:10.5032/jae.2008.04120

Stuart, W. D. (2000). *Influence of sources of communication, user characteristics and innovation characteristics on adoption of a communication technology* [Doctoral dissertation, The University of Kansas]. ProQuest Digital Dissertations. UMI No. AAT 9998115.

Supon, Viola. (1998). Penetrating the barriers to teaching higher thinking. Clearing House. 71(5):294.

Swan, B. G., Wolf, K. J., & Cano, J. (2011). Changes in teacher self-efficacy from the student teaching experience through the third year of teaching. *Journal of Agricultural Education*, *52*(2), 128-139. doi: 10.5032/jae.2011.02128

Talbert, B. A., Vaughn, R., Croom, D. B., & Lee, J. (2014). *Foundations of agricultural education* (3rd ed.).Pearson Education, Inc.

Thompson, Clint. (2013). *Ag teachers in short supply.* College of Agriculture and Environmental Sciences. Retrieved from: https://newswire.caes.uga.edu/story.html?storyid=4659&story=Teacher-shortage

Tippens, A., Ricketts, J. C., Morgan, A. C., Navarro, M., & Flanders, F. B. (2013). Factors related to teachers' intentions to leave the classroom early. *Journal of Agricultural Education, 54*(4), 58-72. doi: 10.5032/jae.2013.04058

True, A. C. (1929). *A history of the agricultural education in the United States 1785-1925.* U.S. Government Printing Office.

Von Crowder. (1997). A participatory approach to curriculum development. Sustainable Development Brief: Food and Agricultural Organizations of the United Nations.

Wellman, J. D. (1987). Images of a profession. *Journal of Forestry 85:*18-19.

Wilent, S. (2011). A high school 'environmental science' class heads to the woods. *The Forestry Source 16*(11): 4-7.

Whittington, A.S., McConnell, E., & Knobloch, N.A. (2006). Teacher efficacy of novice teachers in agricultural education in Ohio at the end of the school year. *Journal of Agricultural Education, 47*(4), 26-38.

Wilson, E., Kirby, B., & Flowers, J. (2002). Factors influencing the intent of North Carolina agricultural educators to adopt agricultural biotechnology curriculum. *Journal of Agricultural Education, 43*(1), 69-81. doi: 10.5032/jae.2002.01069

Wiseman, F. (2003). On the reporting of response rates in Extension Research. *Journal of Extension On-line 41*(3). Retrieved from: http://www.joe.org/joe/2003june/comm1.shtml

Woolfolk Hoy, A., Burke–Spero, R. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education, 21*(4), 343–356. doi: 10.1016/j.tate.2005.01.007a

Wright, Kevin. (2005). *Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research.* J. Computer-Mediated Communication. doi: 10. 10.1111/j.1083-6101.2005.tb00259.x.

Yildirim, A. (1994). Promoting student thinking from the practitioner's point of view: Teachers' attitudes toward teaching. ERIC Documents. March:1-20.

APPENDIX A
IRB APPROVAL

Auburn University Human Research Protection Program

EXEMPTION REVIEW APPLICATION

For information or help completing this form, contact: **THE OFFICE OF RESEARCH COMPLIANCE**
Phone: 334-844-5966 **Email:** IRBAdmin@auburn.edu

Submit completed application and supporting material as one attachment to IRBsubmit@auburn.edu.

1. PROJECT IDENTIFICATION **Today's Date** ______

a. Project Title Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum

b. Principal Investigator Brandon Ray Degree(s) Ph.D Student
Rank/Title Doctoral Candidate Department/School Career and Technical Education/ Curriculum and Teaching
Phone Number 706-506-6110 AU Email blr0029@auburn.edu

Faculty Principal Investigator (required if PI is a student) Dr. Chris Clemons
Title Assistant Professor Department/School Career and Technical Education/ Curriculum and Teaching
Phone Number 334-844-4411 AU Email cac0132@auburn.edu

Dept Head Marilyn Strutchens Department/School Curriculum and Teaching/College of Education
Phone Number 334-844-6838 AU Email strutme@auburn.edu

c. Project Personnel (other PI) – Identify all individuals who will be involved with the conduct of the research and include their role on the project. Role may include design, recruitment, consent process, data collection, data analysis, and reporting. Attach a table if needed for additional personnel.

Personnel Name ______ Degree (s) ______
Rank/Title ______ Department/School ______
Role ______
AU affiliated? ☐ YES ☐ NO If no, name of home institution ______
Plan for IRB approval for non-AU affiliated personnel? ______

Personnel Name ______ Degree (s) ______
Rank/Title ______ Department/School ______
Role ______
AU affiliated? ☐ YES ☐ NO If no, name of home institution ______
Plan for IRB approval for non-AU affiliated personnel? ______

Personnel Name ______ Degree (s) ______
Rank/Title ______ Department/School ______
Role ______
AU affiliated? ☐ YES ☐ NO If no, name of home institution ______
Plan for IRB approval for non-AU affiliated personnel? ______

d. Training – Have all Key Personnel completed CITI human subjects training (including elective modules related to this research) within the last 3 years? YES ☑ NO ☐

The Auburn University Institutional Review Board has approved this Document for use from 10/30/2020 to ---------------
Protocol # 20-524 EX 2010

AU Exemption Form Version 07.14.2020

Version Date (date document created): 11/2/20

page 1 of 8

e. Funding source – Is this project funded by the investigator(s)? ☐ YES ☑ NO
Is this project funded by AU? ☐ YES ☐ NO If YES, identify source _____
Is this project funded by an external sponsor? ☐ YES ☐ No If YES, provide the name of the sponsor, type of sponsor (governmental, non-profit, corporate, other), and an identification number for theaward.
Name_____Type_____Grant # _____

f. List other AU IRB-approved research studies and/or IRB approvals from other institutions that are associated with this project.

_____

2. Mark the category or categories below that describe the proposedresearch:

☐ 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices. The research is not likely to adversely impact students' opportunity to learn or assessment of educators providing instruction. 104(d)(1)

☐ 2. Research only includes interactions involving educational tests, surveys, interviews, public observation if at least ONE of the following criteria. (The research includes data collection only; may include visual or auditory recording; may NOT include intervention and only includes interactions). **Mark the applicable sub-category below (I, II, or III).** 104(d)(2)

☐ (I) Recorded information cannot readily identify the participant (directlyorindirectly/linked); OR
- surveys and interviews: no children;
- educational tests or observation of public behavior: can only include children when investigators do not participate in activities being observed.

☐ (II) Any disclosures of responses outside would not reasonably place participant at risk; OR

☐ (III) Information is recorded with identifiers or code linked to identifiers and IRB conducts limited review; no children. **Requires limited review by the IRB.***

☐ 3. Research involving Benign Behavioral Interventions (BBI)"" through verbal, written responses (including data entry or audiovisual recording) from adult subjects who prospectively agree and ONE of the following criteria is met. (This research does not include children and does not include medical interventions. Research cannot have deception unless the participant prospectively agrees that they will be unaware of or misled regarding the nature and purpose of the research)
Mark the applicable sub-category below (A, B, or C). 104(d)(3)(i)

☐ **(A)** Recorded information cannot readily identify the subject (directly or indirectly/linked); OR

☐ **(B)** Any disclosure of responses outside of the research would not reasonably placesubject at risk; OR

☐ **(C)** Information is recorded with identifiers and cannot have deception unless participant prospectively agrees. **Requires limited review by the IRB.***

☐ 4. Secondary research for which consent is not required: use of identifiable information or identifiable bio-specimen that have been or will be collected for some other 'primary' or 'initial' activity, if one of the following criteria is met. Allows retrospective and prospective secondary use. **Mark the applicable sub-category below (I, II, III, or IV).** 104(d)(4)

☐ (I) Biospecimens or information are publically available;

☐ (II) Information recorded so subject cannot readily be identified, directlyorindirectly/linked; investigator does not contact subjects and will not re-identify thesubjects;OR

☐ (iii) Collection and analysis involving investigators use of identifiable health information when use is regulated by HIPAA "health care operations" or "research or "public health activities and purposes" (does not include biospecimens (only PHI and requires federal guidance on how to apply); OR

☐ (iv) Research information collected by or on behalf of federal government usinggovernment generated or collected information obtained for non-researchactivities.

☐ 5. Research and demonstration projects which are supported by a federal agency/department AND designed to study and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs;(iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs. (must be posted on a federal web site). 104(d)(5) (must be posted on a federal web site)

☐ 6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. The research does not involve prisoners as participants. 104(d)(6)

New exemption categories 7 and 8: Both categories 7 and 8 require Broad Consent. (Broad consent is a new type of informed consent provided under the Revised Common Rule pertaining to storage, maintenance, and secondary research with identifiable private information or identifiable biospecimens. Secondary research refers to research use of materials that are collected for either research studies distinct from the current secondary research proposal, or for materials that are collected for non-research purposes, such as materials that are left over from routine clinical diagnosis or treatments. Broad consent does not apply to research that collects information or biospecimens from individuals through direct interaction or intervention specifically for the purpose of the research.) **The Auburn University IRB has determined that as currently interpreted, Broad Consent is not feasible at Auburn and these 2 categories WILL NOT BE IMPLEMENTED at this time.**

***Limited IRB review – the IRB Chairs or designated IRB reviewer reviews the protocol to ensure adequate provisions are in place to protect privacy and confidentiality.**

****Category 3 – Benign Behavioral Interventions (BBI) must be brief in duration, painless/harmless, not physically invasive, not likely to have a significant adverse lasting impact on participants, and it is unlikely participants will find the interventions offensive or embarrassing.**

3. PROJECT SUMMARY

a. Does the study target any special populations? (Mark applicable)

Minors (under 18 years of age)	☐ YES ☑ NO
Pregnant women, fetuses, or any products of conception	☐ YES ☑ NO
Prisoners or wards (unless incidental, not allowed for Exempt research)	☐ YES ☑ NO
Temporarily or permanently impaired	☐ YES ☑ NO

b. Does the research pose more than minimal risk to participants? ☐ YES ☑ NO

Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or test. 42 CFR 46.102(i)

c. Does the study involve any of the following?

Procedures subject to FDA regulations (drugs, devices, etc.)	☐ YES ☑ NO
Use of school records of identifiable students or information from instructors about specific students.	☐ YES ☑ NO
Protected health or medical information when there is a direct or indirect link which could identify the participant.	☐ YES ☑ NO
Collection of sensitive aspects of the participant's own behavior, such as illegal conduct, drug use, sexual behavior or alcohol use.	☐ YES ☑ NO
Deception of participants	☐ YES ☑ NO

4. Briefly describe the proposed research, including purpose, participant population, recruitment process, consent process, research procedures and methodology.

The purpose of this study was to investigate Georgia secondary agriscience teachers' perception and attitudes regarding barriers they may experience within the classroom. The following is an overview of the research objectives within this study:
1. Identify and describe the personal characteristics of high school agricultural education teachers in Georgia.
2. Describe the perceived importance of the forestry and natural resources curriculum for high school agricultural education teachers.
3. Describe the perceived level of instructor competence of the forestry and natural resources curriculum for high school agricultural education teachers.
The population of this study will be randomly stratified using Georgia Agriculture teachers in grades 9-12. Stratification will be representative of each of the three FFA Regions in Georgia: North, Central, and South. There were 138 high school teachers in the North Region (69 in both Area 1 and Area 2), 111 in the Central Region (61 in Area 3 and 50 in Area 4), and 109 in the South Region (55 in Area 5 and 54 in Area 6). The North Region of Georgia encompasses all counties North from Carroll to Lincoln. The Central Region includes counties from Heard to

5. Waivers

Check any waivers that apply and describe how the project meets the criteria for the waiver. Provide the rationale for the waiver request.

- ☐ **Waiver of Consent (including existing de-identified data)**
- ☑ **Waiver of Documentation of Consent (Use of Information Letter)**
- ☐ **Waiver of Parental Permission**

All retrospective information will be de-identified.

Survey items will be delivered to subjects using Qualtrics online survey tool (see www.qualtrics.com). Auburn University has a site license for Qualtrics. Subjects will receive an initial email from the researcher requesting their participation, and subjects will be informed they will be contacted with a participation request three additional times during the 3 weeks following the initial request. Qualtrics.com provides a Reminder Function that only sends a reminder to those who have not completed the survey, including both those who started the survey but didn't finish and those who never started the survey. Subjects will be provided information in the e-mail solicitation request regarding the process for opting out to have their names removed from any future electronic mailings requesting their participation. (See email solicitation request.) Subjects agreeing to participate will select a link to the online survey within the email solicitation. Individual items are set to request subjects to complete unanswered items; however, a subject may skip an item. The online survey has been developed so subjects are not forced to answer any particular

6. Describe how participants/data/specimens will be selected. If applicable, include gender, race, and ethnicity of the participant population.

The population for this study will consist of the 358 high school agriculture educators, grades 9-12 in Georgia. The recruitment of participants will be completed using publicly available email addresses obtained through the Georgia State Department of Education, Division of Agriculture Education (gaaged.org). An initial email with the invitation to participate will be sent to participants with the informational letter detailing the parameters, requirements, and methods of the study. Participants indicating their inclusion will be directed to the online survey hosted by Qualtrics. This data will be downloaded by the research and a unique code for each respondent will be generated. Codes and identifying information will be stored separately as to avoid a breach of confidentiality beyond the researchers involved in the project. The survey will be a modified version of the "Pre-service and Inservice agricultural education needs assessment for Georgia", and consists of two sections. Section I is designed to assess opinions regarding the needs of agricultural educators. This information will be used in planning future beginning teacher courses and in-service courses for agriculture teachers. Section II will request information about the participants. The population of this study will be randomly stratified using Georgia Agriculture teachers in grades 9-12. Stratification will be representative of each of the three FFA Regions in Georgia: North, Central, and South. A representative sample will be selected from these areas using the criteria for inclusion within the study:

1. Georgia Agriculture certification or provisional teaching credentials in Agriculture Education.
2. Currently employed to the equivalent of one FTE as an agriculture teacher in Georgia.
3. Greater than or equal to one year as an agriculture teacher.

7. Does the research involve deception? ☐ YES ☒ NO If YES, please provide the rationale for deception and describe the debriefing process.

8. **Describe why none of the research procedures would cause a participant either physical or psychological discomfort or be perceived as discomfort above and beyond what the person would experience in daily life.**

Participants will be asked to answer needs-based questions using Qualtrics Software for Surveys. This research study is anonymous. No one, including the researcher, will be able to associate responses with identity. Participation is completely voluntary. The risks associated with participating in this study are loss of anonymity. To minimize these risks, we will assign participant's unique codes only accessible the researchers of this study. Any information obtained in connection with this study will remain anonymous and confidential. Particpants can withdraw at any time by (example: closing the browser window). Participation involves minimal risk (no more than occurs during daily life). Information about participants will be kept confidential and no individual responses will be reported.

9. **Describe the provisions to maintain confidentiality of data, including collection, transmission, and storage.**

Data will be initially stored on Qualtrics.com during the response period of the study. Once data is ready for download, it will be transferred to my computer at the Jay Phil Campbell Research and Education Center in Watkinsville, Ga. My computer is password protected. It is set per Georgia Agriculture Education parameters to automatically lock and display a logon screen requiring a password after a set period of inactivity. I also lock my computer and office anytime I am away from my desk.
Qualtrics.com states it "has SAS 70 Certification and meets the rigorous privacy standards imposed on health care records by the Health Insurance Portability and Accountability Act (HIPAA). All Qualtrics accounts are hidden behind passwords and all data is protected with real-time data replication."

10. **Describe the provisions included in the research to project the privacy interests of participants (e.g., others will not overhear conversations with potential participants, individuals will not be publicly identified or embarrassed).**

Identifying information will be retained for one year and the coding identifiers will be deleted from the researcher's computer, and hard copy information will be shredded. Participants will be contacted based on randomization of subjects for recruitment within the study. Name, contact and email information will be collected to initiate the survey, however, the contact information will only be retained for future studies. The researchers will not be able to connect any identifying data with individual responses during or after the respondent submits the survey through Qualtrics. Hard copy data will be stored in a locked file cabinet in office 149, Jay Phil Campbell Research and Education Center (UGA) in Watkinsville, Ga. Identifying codes for participants will be stored on a password protected computer. This assures identification codes are consistently separated from participant identifiers.

11. **Will the research involve interacting (communication or direct involvement) with participants?**
☒ **YES** ☐ **NO If YES, describe the consent process and information to be presented to subjects. This includes identifying that the activities involve research; that participation is voluntary; describing the procedures to be performed; and the PI name and contact information.**

The recruitment of participants will be completed using publicly available email addresses obtained through the Georgia State Department of Education, Division of Agriculture Education (gaaged.org). An initial email with the invitation to participate will be sent to participants with the informational letter detailing the parameters, requirements, and methods of the study. Participants indicating their inclusion will be directed to the online survey hosted by Qualtrics. Subjects will be provided information in the e-mail solicitation request regarding the process for opting out to have their names removed from any future electronic mailings requesting their participation. (See email solicitation request.) The sole item that forces a response is the prompt that queries "Are you interested in participating in this survey?" A response of "No" directs the respondent to the end of the survey. If the respondent fails to provide the requested information for this prompt, the online survey is set to request a response but will not require a response in the event the respondent changes her or his mind and does not want to provide contact information. In lieu of the signed consent letter, the information letter outlines the procedures of the study and the voluntary inclusion or exclusion of the respondent. If the respondent chooses to participate, they indicate their informed consent and acceptance of the terms of the study by completing the survey. If a respondent chooses not to participate, a click of "no" removes them from any further communication. Participation is completely voluntary. Participants can withdraw at any time by (example: closing the browser window). Participation involves minimal risk (no more than occurs during daily life). Information about participants will be kept confidential and no individual responses will be reported.

12. Additional information and/or attachments.

In the space below, provide any additional information you believe may help the IRB review of the proposed research. If attachments are included, list the attachments below. Attachments may include recruitment materials, consent documents, site permissions, IRB approvals from other institutions, etc.

A review of the existing literature shows a lack of information and importance of forestry and natural resources placed within high school. A 2007 survey found that teenagers do not recognize professional career opportunities in forestry and that forestry is the least popular of the natural resource fields (Hagar et. al., 2007). According to the Georgia Agricultural Education Annual Report (2019) there are fewer forestry/natural resources pathway classes being taught in high school Agricultural Education settings than any other classes within the major pathway areas . With the need for a more skilled labor force in forestry a greater need is placed on our high school instructors to be knowledgeable and emphasize forestry/natural resources curriculum within their classes.

A limited review of the literature shows that undergraduate enrollment in U.S. forestry degree programs has been dropping at about 4% per year from the mid-1900s through the early part of the 21st century (Sharik et al., 2004). While instructors believe that these concepts are important, many believe they are deficient in teaching them. Fowler (2012) conducted a survey of high school science teachers investigating their forestry education attitudes and teaching practices. Eighty-two percent of those teachers agree forestry should be taught in high schools, but only 34% of these teachers agreed or strongly agreed that they feel confident to teach forestry concepts. Friend (2008) surveyed West Virginia agricultural education teachers to determine the knowledge and attitudes of forestry education. Approximately 95 percent of those respondents agreed or strongly agreed that forestry should be a class taught by agricultural education teachers. Challenges that these teachers faced, most frequently mentioned was lack of knowledge, lack of resources, lack of time, lack of student knowledge. Both of Lane and Wilkie (1994) and Sebasto (1998) conducted studies that found that teachers believe environmental education is very important but they actually incorporate very little.

The population of this study will consist of Georgia Agricultural Teachers in each of the 3 FFA regions. Survey instruments will be emailed to participants and will consist of a modified version of the Minnesota Agricultural Education Teacher Inservice Programming Needs Assessment (Joerger, 2002) and the Assessing the Technical Expertise and Content Needs of Alabama Agriscience Teachers (Clemons, 2018). A panel of experts will validate the modified instrument prior to the instrument being distributed. Both descriptive and inferential statistics will be employed using SPSS 24 for the analysis of teacher content and technical needs, professional development interests, and variable trends between teaching experience and geographical location within Georgia.

Principal Investigator's Signature Brandon Ray Digitally signed by Brandon Ray CN=... Date: 2020.11.02 16:56:35 -05'00' **Date** _____

If PI is a student,
Faculty Principal Investigator's Signature Christopher Clemons Digitally signed by Christopher Clemons Date: 2020.11.03 11:26:56 -05'00' **Date** _____

Department Head's Signature Marilyn Strutchen Digitally signed by Marilyn Strutchen Date: 2020.11.03 15:36:55 -05'00' **Date** _____

APPENDIX B
PILOT SURVEY RUBRIC

Dear Participants,

Thank you for your willingness to participate in this pilot study for the purposes of identifying "Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum." Your willingness to complete this survey will aid in the improvement and development of professional development programs. All information will remain confidential and will not be shared outside of the lead researcher. At the conclusion of the survey analysis, all materials, including demographic data and emails will be destroyed. Please complete the survey while also filling out the rubric below. You can print out and write on this sheet, scan, and email back OR fill it in online and email back. Use the comments section at the bottom for any specific items you see during the completion of the survey (grammar, spelling, and other suggestions as they relate).

Category	***Rating***				***Score***
	4	**3**	**2**	**1**	
Purpose	Purpose is stated clearly.	Purpose is stated somewhat clearly.	Purpose is stated vaguely.	Purpose is not stated.	
Clarity of directions	Directions are crystal clear and a person would not have to ask for clarification.	Directions are very clear and a person might have to ask for clarification.	Directions are somewhat clear and a person would have to ask for clarification.	Directions are confusing and ambiguous.	
Clarity of questions	Questions are crystal clear and a person would not have to ask for clarification.	Questions are very clear and a person might have to ask for clarification.	Questions are somewhat clear and a person would have to ask for clarification.	Questions are confusing and ambiguous.	
Choice of responses	Every person would be able to choose from the responses.	Most people would be able to choose from the responses.	Few people would be able to choose from the responses.	No one would be able to choose from the responses.	
Layout	The selection of graphics, line styles, and arrangement options enhances the layout and meaning of the survey.	The selection of graphics, line styles and arrangement options mostly enhances the layout of the survey.	The selection of graphics, line styles and arrangement options sometimes enhances the layout of the survey.	The selection of graphics, line styles and arrangement options do not enhance the layout of the survey.	

Flow	The questions and transitions between constructs were easy to follow	The questions and transitions between constructs were somewhat easy to follow	The questions and transitions between constructs were not easy to follow	There was no flow between questions and constructs	
Spelling/ Grammar	All words are spelled correctly. Grammar, punctuation, spacing and word usage are appropriate.	Most words are spelled correctly. Grammar, punctuation, spacing and word usage are mostly appropriate.	Most words are spelled correctly. Grammar, punctuation, spacing and word usage have some errors.	Numerous spelling errors. Grammar, punctuation, spacing and word usage have a number of errors.	
Ease of Use	Easy to use and pleasant to look at.	Easy to follow.	Choppy, but gets the job done.	Difficult to follow and is jumbled.	
Personal Characteristic Questions	Personal characteristics needed are crystal clear and a person would not have to ask for clarification.	Personal characteristics needed are very clear and a person might have to ask for clarification.	Personal characteristics needed are somewhat clear and a person would have to ask for clarification.	Personal characteristics needed are confusing and ambiguous.	
Total Score (Out of 36)					

Introductory Email Comments/Suggestions: _____
_____
_____
_____

Spelling/Grammar Corrections: _____
_____
_____
_____

Questionnaire Comments/Suggestions: _____
_____
_____
_____

APPENDIX C

RESEARCH QUESTIONNAIRE

Q1

Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum

We are conducting this study and invite you to participate. This study is best taken on a desktop/laptop/tablet; given the type of questioning used participation on a smartphone may be problematic. You and other agricultural educators in Georgia are the only source of data for this study. We ask you to review the informed consent information sheet (details) and complete the accompanying questionnaire. **Your participation will take about 10 minutes.** Things you should know about your participation: Your participation is voluntary. You may stop participating at any time. You will not be compensated for participation. Participation involves minimal risk (no more than occurs during daily life). Information about participants will be kept confidential and no individual responses will be reported.

Please do not hesitate to contact Brandon Ray or Dr. Chris Clemons (Major Advisor) if you have any questions about this research project. For further information, click the "Information Letter" link below.

Information letter

This survey should take approximately 10 minutes to complete.

Thank you!

Brandon Ray
Doctoral Student
Agriscience Education
Auburn University
706-506-8110
blr0029@auburn.edu

Chris Clemons, Ph.D.
Assistant Professor
Agriscience Education
Auburn University
cac0132@auburn.edu

○ I **AGREE** to participate (I have read the informed consent information sheet and agree to participation) (1)

○ I **DO NOT** wish to participate (2)

Skip To: End of Survey If Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum We are... = I DO NOT wish to participate

End of Block: Consent

Start of Block: Block 14

Q2 **Please check the following that applies to you about teaching a forestry/wildlife pathway.**

- ○ YES, I currently teach the forestry/wildlife pathway. (1)
- ○ YES, I have taught the forestry/wildlife pathway in the past, but am not currently teaching it. (2)
- ○ NO, I am not currently teaching the forestry/wildlife pathway and have no plans to in the future. (3)
- ○ NO, I am not currently teaching the forestry/wildlife pathway, but would like to in the future. (4)

End of Block: Block 14

Start of Block: Survey Overview/Directions

Q3
Directions: For each of the following topics, indicate your perceived level of **IMPORTANCE** *in the middle column*, and your perceived level of **COMPETENCY** in the *right column*.

Overview: This needs assessment is comprised of 3 sections which ask your perceived importance of content within forestry/natural resources related standards, your level of competence regarding instruction, and personal characteristics. Responses will be kept confidential.

End of Block: Survey Overview/Directions

Start of Block: Example

Q4

End of Block: Example

Start of Block: S.1 Natural Resource Management

Q5 **Section 1.1: Teaching Natural Resource Management:** These items will help state staff and university officials understand the teaching and learning needs of both beginning and veteran agriculture teachers. The following questions are based on Georgia Agriculture Education Standard AFNR-BAS-6: Describe soil formation and management and assess its relevance to plant/animal production and natural resources management.

	Level of Importance					**Level of Competence**				
	Not Important (1)	Of Little Importance (2)	Somewhat Important (3)	Important (4)	Very Important (5)	Not Competent (1)	Little Competence (2)	Somewhat Competent (3)	Competent (4)	Very Competent (5)

Teaching about concepts in natural resource management in a Basic Agriscience class. (1)	○	○	○	○	○	○	○	○	○	○
Teaching concepts in soil formation. (2)	○	○	○	○	○	○	○	○	○	○
Teaching soil components. (3)	○	○	○	○	○	○	○	○	○	○
Teaching concepts within soil ecosystems. (4)	○	○	○	○	○	○	○	○	○	○
Teaching concepts in slope. (5)	○	○	○	○	○	○	○	○	○	○
Teaching concepts in soil texture. (6)	○	○	○	○	○	○	○	○	○	○
Teaching concepts in soil erosion. (7)	○	○	○	○	○	○	○	○	○	○

Teaching how to determine land class on a given site. (8)	○	○	○	○	○	○	○	○	○	○
Teaching concepts in selecting appropriate soil management practices for a given land class. (9)	○	○	○	○	○	○	○	○	○	○
Teaching about careers in the Natural Resources industry. (10)	○	○	○	○	○	○	○	○	○	○

End of Block: S.1 Natural Resource Management

Start of Block: S. 2 Forest Science

Q6 Section 2.2: Teaching Forest Science: These items will help state staff and university officials understand the teaching and learning needs of both beginning and veteran agriculture teachers. The following questions are based on Georgia Agriculture Education Standard AFNR-BAS-10: Demonstrate basic skills in natural resources.

	Level of Importance					Level of Competence				
	Not Important (1)	Of Little Importance (2)	Somewhat Important (3)	Important (4)	Very Important (5)	Not Competent (1)	Little Competence (2)	Somewhat Competent (3)	Competent (4)	Very Competent (5)

Teaching about Forestry in a Basic Agriscience class (1)	○	○	○	○	○	○	○	○	○	○
Teaching about tree functions. (2)	○	○	○	○	○	○	○	○	○	○
Teaching concepts in measuring forest products. (3)	○	○	○	○	○	○	○	○	○	○
Teaching identification of basic equipment used in forestry. (4)	○	○	○	○	○	○	○	○	○	○
Teaching identification of important species of trees in Georgia. (5)	○	○	○	○	○	○	○	○	○	○
Teaching identification of forest pests. (6)	○	○	○	○	○	○	○	○	○	○

Teaching management of forest pests. (8)	○	○	○	○	○	○	○	○	○	○
Teaching about careers in the forestry industry. (7)	○	○	○	○	○	○	○	○	○	○

End of Block: S. 2 Forest Science

Start of Block: S.3 Wildlife Management

Q7 **Section 3.3: Teaching Wildlife Management:** These items will help state staff and university officials understand the teaching and learning needs of both beginning and veteran agriculture teachers. The following questions are based on Georgia Agriculture Education Standard AFNR-BAS-10: Demonstrate basic skills in natural resources.

	Level of Importance					**Level of Competence**				
	Not Important (1)	Of Little Importance (2)	Some what Important (3)	Important (4)	Very Important (5)	Not Competent (1)	Little Competence (2)	Some what Competent (3)	Competent (4)	Very Competent (5)

Teaching about wildlife management in a Basic Agriscience class. (1)	○	○	○	○	○	○	○	○	○	○
Teaching the definition of wildlife. (2)	○	○	○	○	○	○	○	○	○	○
Teaching the difference between game and non-game species. (8)	○	○	○	○	○	○	○	○	○	○
Teaching identification of important species of wildlife in Georgia. (3)	○	○	○	○	○	○	○	○	○	○
Teaching strategies in managing wildlife. (4)	○	○	○	○	○	○	○	○	○	○
Teaching skills in aquaculture. (5)	○	○	○	○	○	○	○	○	○	○

Teaching skills in vertical farming. (6)	○	○	○	○	○	○	○	○	○	○
Teaching about careers in the wildlife management industry. (7)	○	○	○	○	○	○	○	○	○	○

End of Block: S.3 Wildlife Management

Start of Block: Section 4: Participant Characteristics

Q8 **Section 4.1: Personal Characteristics.** The following questions/statements are written to help us better understand your professional characteristics as an agriscience education teacher in Georgia. Your responses are anonymous and will not be shared beyond the researcher and the major advisor.

Q9 **What is your age?**

- 21-25 (2)
- 26-30 (3)
- 31-35 (4)
- 36-40 (5)
- 41-45 (6)
- 46-50 (7)
- 51-55 (8)
- 56-60 (9)
- 61 and older (14)

Q10 **What is your gender?**

- Female (2)
- Male (3)
- Other (5)
- Prefer not to say (6)

Q11 **Please specify your race.**

- White (2)
- Hispanic or Latino (3)
- Black or African American (4)
- Native American or American Indian (5)
- Asian/Pacific Islander (6)
- Other (7)

Q12 **Including this year how long have you been teaching agriculture education?**

- 1-5 (2)
- 6-10 (3)
- 11-15 (4)
- 16-20 (5)
- 21-25 (6)
- 26-30 (7)
- 31-35 (8)
- 36 years or more (9)

Page Break

Q13 **Which option below best describe your formal teacher preparation?**

- ○ Undergraduate teacher education program (full Ag Ed Certification) (2)
- ○ Graduate program with teacher certification (3)
- ○ Combined Undergraduate and Graduate Program (4)
- ○ Substitute teaching that led to a permanent position (5)
- ○ Alternate Teacher Certification (6)
- ○ No prior teaching experience, but I have a degree in an agriculturally related field (7)
- ○ Certified in content area outside of Ag Ed (8)
- ○ No prior teaching experience and do not have a degree in an agriculturally related field (9)

Q14 **What is the highest degree you have completed?**

- ○ Undergraduate Degree (2)
- ○ Master's Degree (3)
- ○ Educational Specialist (4)
- ○ Doctorate Degree (5)

Q15 **Which Georgia FFA Region do you teach in?**

- ○ North Region (2)
- ○ Central Region (3)
- ○ South Region (4)

Q16 **The type of community I teach in each day is best described as being:**

- ○ Rural (1)
- ○ Urban (2)
- ○ Suburban (3)

Page Break

Q17 **I have career experience beyond teaching in the following areas (Check all that apply).**

- ☐ Forestry (9)
- ☐ Wildlife Management (10)
- ☐ Natural Resource Management (11)
- ☐ None of these (12)

Q18 I have personal experiences beyond teaching in the following areas (Check all that apply).

- ☐ Forestry (1)
- ☐ Wildlife Management (2)
- ☐ Natural Resource Management (3)
- ☐ None of these (4)

Q19 What form(s) of in-service delivery would you prefer? (Check all that apply)

- [ ] 8 hour workshop during the summer (1)
- [ ] 2 day workshop during the summer (2)
- [ ] Week long workshop (3)
- [ ] In-service session at summer GVATA (4)
- [ ] 1 day weekend course during the school year (5)
- [ ] Certification course offered through the University (6)
- [ ] Virtual seminars (7)

End of Block: Section 4: Participant Characteristics

APPENDIX D
INFORMATION LETTER

INFORMATION LETTER
for a Research Study entitled
"Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum"

You are invited to participate in a research study titled "Perceived Barriers Affecting the Implementation of Forestry/Natural Resources Curriculum." The purpose of this study is to determine the perceived barriers that agriculture teachers are experiencing in their classrooms when implementing forestry/natural resources curriculum.
To accomplish this purpose, the following research objectives will be used to guide this study:

1. Identify and describe the personal characteristics of high school agricultural education teachers in Georgia.
2. Describe the perceived importance of the forestry and natural resources curriculum for high school agricultural education teachers.
3. Describe the perceived level of instructor competence of the forestry and natural resources curriculum for high school agricultural education teachers.

The study is being conducted by Brandon Ray, a doctoral student in the Career and Technical Education program at Auburn University and Dr. Chris Clemons, advisor and assist professor of curriculum and teaching. You are invited to participate because you hold a Georgia Agricultural Education certification of provisional teaching credentials in Agricultural Education, currently employed to the equivalent of one Full-Time Equivalent (FTE) as an agriscience teacher in Georgia, possess greater than or equal to one year as an agriculture teacher, and are age 19 or older.

What will be involved if you participate? Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to complete an online survey. You will click on the link in the email that will direct you to the online survey hosted by Qualtrics. Your total time commitment will be approximately 10 minutes. Participants indicating their inclusion will be directed to the online survey hosted by Qualtrics.

Are there any risks or discomforts? A risk associated with participating in this study are loss of anonymity. To minimize this risk, we will assign participant's unique codes only accessible the researchers of this study. Your privacy will be protected. Any information obtained in connection with this study will remain anonymous and confidential.

Are there any benefits to yourself or others? While participants within this study will not directly benefit, it will provide more clarification on professional development needs within forestry for Georgia Agricultural Educators.

Are there any costs? If you decide to participate, you will not have costs or compensation associated with their participation.

The Auburn University Institutional
Review Board has approved this
Document for use from
10/30/2020 to ----------
Protocol # 20-524 EX 2010

If you change your mind about participating, you can withdraw at any time by (example: closing your browser window). If you choose to withdraw, your data will be withdrawn. Once you've submitted your data, it cannot be withdrawn. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University or the Department of Curriculum and Teaching.

Any data obtained in connection with this study will remain anonymous. We will protect your privacy and the data you provide by destroying all data and identifiers at the conclusion of the study. Information collected through your participation may be published in professional Agriculture Education journals and presented at professional conferences.

If you have questions about this study, please contact Brandon Ray at blr0029@auburn.edu, or my advisor, Dr. Chris Clemons, at cac0132@auburn.edu.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334) 844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION ABOVE, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, PLEASE CLICK ON THE LINK BELOW.
YOU MAY PRINT A COPY OF THIS LETTER TO KEEP.

Principal Investigator: Brandon Ray

Faculty Investigator: Dr. Chris Clemons

The Auburn University Institutional Review Board has approved this document for use from _____ *to September* _____. *Protocol #*_____.

The Auburn University Institutional Review Board has approved this Document for use from
10/30/2020 to ----------
Protocol # 20-524 EX 2010