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Implementing Forestry and Natural Resource Curricula in Georgia. A Quantitative Analysis of Perceived Barriers Towards Implementation

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Abstract

There are fewer forestry/natural resources pathway classes being taught in Georgia high schools in relation to other commonly associated agriculture curricula (Georgia Agriculture Education, 2019). The purpose of this study was to investigate school-based agriculture education (SBAE) teachers' perceptions of forestry/natural resources curriculum to investigate internal barriers towards implementation of the curricula. The participants of this study were Georgia SBAE agriculture teachers (N = 358). This study utilized a quantitative non-experimental survey research design. The findings of the study yielded data that reveals 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 to identify training needs of teachers within Georgia. Teachers that had more years of experience had the greatest discrepancy between perceived importance and perceived competence. Teachers with no personal experiences in forestry, natural resources, and/or wildlife management had a significant need for training within those concepts. The recommendations of this study support university and state staff address different avenues to market the core subjects within agriculture education, cultivate partnerships with forestry and natural resources professionals, and SBAE teachers should seek to bring individuals into their classroom to promote forestry/natural resources careers.

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Introduction

Selecting agriculture career readiness pathways has become an important component of a comprehensive school-based agriculture education program, operationally defined for the purposes of this manuscript as SBAE. SBAE teacher's actively experience a variety of different barriers that can greatly affect student learning (Johnson, 2007). Georgia SBAE agriculture pathways are a series of three interrelated courses to develop SBAE student's skills and expertise. As curriculum needs and delivery methods evolve within SBAE, so must the lessons that are taught within the classroom (Clemons et al., 2018)

The purpose of this study was to assess SBAE teacher perceptions of competence and importance related to the inclusion of forestry and natural resources curricula in SBAE programs. Shumacher et al. (2012) reported 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 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 highlight the lack of forestry/natural resources concepts being taught Georgia schools.

Professionals employed in forestry and natural resources conserve and manage our forests and natural resources. The value of the forest industry in Georgia is historically prevalent from state's colonial establishment. The 1870 census reported (Georgia Forestry Commission, 2019) 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. During the 1900's the economic value of production-based forestry/timber enterprises in Georgia expanded the need for conservation education. With the increase in production there was a corresponding need for a more skilled and educated labor force. This need for forestry education led to the formation of the Georgia School of Forestry and Natural Resources in 1906 and the Georgia Forestry Association in 1907 (Izlar, 2006).

In 2018, there were (N = 453) agricultural education instructors in Georgia with approximately (n = 341) being high school instructors (Georgia Agricultural Education, 2019). With the need for a more skilled labor force in forestry, demands are placed on SBAE 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) reported 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 one percent considered themselves to be "well-informed" about forestry.

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). Lambert (2017) noted a change in the composition in the agriculture, forestry, fishing, and hunting sector(s) workforce. Employment opportunities in forestry/natural resources fell dramatically for under employed workers, more wage hours were supplied by workers with some college, college degrees, or post-baccalaureate degree. From 1947-2010 the forestry/natural resources sector experience a rapid decline in the total number of productivity hours performed by the workforce having less than a high school degree. Lambert (2017) reported that since 1980 a 94% decrease in hours of work experienced by forestry specialists and a 28% reduction in hours of specialists possessing a high school diploma. This creates a need for forestry/natural resources curricula to be addressed in SBAE programs.

Agricultural educators must be able grasp the specific content areas that they are required to teach. Wilent (2011) reported a noticeable information gap existed between the types of forestry information being presented. Smith (2011) stated 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).

Conceptual Framework

The value and application of forestry/natural resources curricula is often a collaboration between educational learning standards and SBAE teacher's perception of importance and competency. Shumacher et al. (2012) noted the value of a proactive environmental science curriculum and the abundance of support (administration, teachers, and parents) often associate with a wholistic SBAE program. The Borich (1980) needs assessment served as the instrumentation model for this study to more clearly define levels of importance and confidence related to teacher perceptions of forestry and natural resources curricula.

Needs Assessment Model

Borich's needs assessment model is useful because it produces clear and specific recommendations for professional growth and development. Institutions that train individuals are continually looking for ways to improve their training programs. The Borich needs assessment model calculates the Mean Weighted Discrepancy Scores (*MWDS*) to identify priorities of participants. (Ashraf et al., 2020). This model measures the discrepancy between competency and importance of skills and knowledge to improve professional and programmatic needs

The difference between competency 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). Historically, needs assessment models

have utilized variations of determining importance and competency when investigating SBAE teacher's perceptions of curricula (Garton & Chung, 1996; Joerger, 2002; Layfield & Dobbins, 2002).

Purpose and Research Questions

The purpose of this study was to assess SBAE teacher perceptions of competence and importance related to the inclusion of forestry and natural resources curricula in SBAE programs. Three research questions guided this investigation to better understand forestry curricula needs: which personal characteristics best identify and describe high school agricultural education teachers, and what are the perceived levels of instructor importance of the forestry and natural resources curriculum for secondary SBAE teachers, and what are the perceived level(s) of instructor competence of the forestry and natural resources curriculum for high school agricultural education teachers. This research study aligns closely with research priority three of the American Association of Agriculture Education's research area, question two: "what methods, models, and practices are effective in recruiting agricultural leadership, education, and communication practitioners (teachers, extension agents, etc.) and supporting their success at all stages of their careers" (Stripling & Ricketts, 2016, p. 31).

Methods

A statewide study was conducted to determine teacher perceptions relating to perceived forestry/natural resources curriculum barriers teachers may experience when implementing forestry and natural resources curricula. The population included all secondary SBAE teachers in Georgia (N = 358) possessing a valid Georgia agriculture education certificate, having no less than one year of teaching experience, and currently employed as a SBAE teacher. The Georgia Vocational Agriculture Teacher's, operationally defined as GVATA membership roster was obtained through the Georgia agriculture education program manager and contained potential participants schools, counties, areas, regions, and teacher names. Email addresses were accessed from the Georgia agriculture education teacher directory. Middle school agriscience teachers (n = 95) were excluded from the study due to differences in high school and middle school Georgia Performance Standards. There were 138 (n = 138) secondary school SBAE teachers in the North Region (Area 1 and Area 2), 111 (n = 111) in the Central Region (Area 3 and Area 4), and 109 (n = 109) in the South Region (Area 5 and Area 6).

This descriptive research study used a quantitative non-experimental survey design. Ary et al. (2010) reported quantitative research as a review of operations which produce answers to pre-determined questions. This study sought to observe relationships and discrepancies, but not manipulate any variables thus making it non-experimental in nature (Ary et al., 2010).

Lindner et al. (2001) reported the importance of using pilot study groups to address instrumentation for content and face validity. The pilot study is vital to mitigate the potential of measurement error and identify any statements or question deemed inappropriate for the objectives being investigated. The pilot review panel included 17 (n = 17) secondary SBAE in Georgia and were representative of the population being investigated. The pilot study consisted of 28 statements/questions, addressed the clarity of instructions for completing the instrument, choice of responses, reliability of statements/questions and general. The pilot study review produced 15 (n = 15) completed instrument evaluations. Participants reported minimal changes to instrument and from this analysis two statement/questions were removed from the final

instrument. Pilot study participants characteristics and data were not included in the completed research analysis or findings.

Chronbach's alpha coefficient was calculated to determine the reliability of importance (*I*) and competency (*C*) for each construct. Reliability was reported for natural resources management (α^I = .829 and α^C = .960), forest science (α^I = .873 and α^C = .969), and wildlife management (α^I = .855 and α^C = .970). Overall instrument reliability was reported as (α^I = .906 and α^C = .982).

Final study participants completed a two-part Borich model 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 final instrument consisted of 26 items 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). All participants completed the 10-minute electronic questionnaire desktop computers, tablets, or other internet connected devices. Dillman et al. (2014) supported the use of digital survey design software for efficiency, data collection, access, reporting, and cost. Participants were contacted using an introductory email and provided a one-time internet hyperlink to the questionnaire and information letter, alleviating the concern for "ballot-stuffing". 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.

The instrument had an initial response rate 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 e-mail address. The email reminders yielded 38 (*n* = 38, % = 11), 48 (*n* = 48, % = 14), and 49 (*n* = 49, % = 14) additional respondents, respectively. The total instrument response rate was 54% (n = 187). Lindner et al. (2001) recommended using an independent t-test to control for non-response error. No statistical significance was present between early and late respondents. The results indicated no statistical significance between early and late respondents. Descriptive statistical analysis was used to analyze the data and was consistent with the methods used by Blackburn et al. (2017).

Findings

The results of this study are represented in table summary and represent the analysis of SBAE teacher perceptions of forestry and natural resources curriculum as potential internal barriers to implementing curriculum. The instrument was composed of 26 statements in three sections and participant characteristic data.

Characteristics of Georgia Secondary SBAE Teachers

Study participants were asked to self-describe their professional and personal characteristics. Personal characteristics (Table 1) of the sample indicated consistency with the population of secondary SBAE teachers in Georgia. A total of 187 Georgia secondary SBAE teachers completed the questionnaire. Partial or incomplete responses were excluded (*n* = 15) leaving 173 completed and intact responses. Male teachers comprised the largest gender group of participants (*n* = 99, % = 57.22), while female respondents represented 42.19% (*n* = 73), with one participant reporting "other" (*n* = 1, % = 0.58). There were 164 respondents (*n* = 164, % = 94.79)

self-reported Caucasian/White, (*n* = 2, % = 1.16) Hispanic/Latino and (*n* = 7, % = 4.05) Black/African American respondents. Participants with one to five years of teaching experience were reported as (*n* = 53, *%* = 30.64). The remaining participants characteristics reported SBAE teaching experience as six-ten 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). SBAE teachers in Georgia agricultural education regions were 46.84% (*n* = 81) north region, 25.42% (*n* = 44) central region, and 27.74% (*n* = 48) south region.

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. Participants were also asked to identify the highest degree earned and reported bachelor's (*n* = 49, % = 28.32), master's degree (*n* = 69, % = 39.88), education specialist degree (*n* = 48, % = 27.75) and doctoral degree (*n* = 7, % = 4.05)

Table 1

Personal Characteristics of Georgia High School SBAE Teachers

		n	%
Gender	Male	99	57.22
	Female	73	42.19
	Other	1	0.58
Ethnicity	Caucasian/White	164	94.79
	Hispanic or Latino	2	1.16
	Black or African American	7	4.05
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
Ag Ed Region	North	81	46.84
	Central	44	25.42
	South	48	27.74
Community Setting	Rural	116	67.05
	Urban	18	10.40
	Suburban	39	22.54
Highest Degree	Bachelor's	49	28.32
	Master's	69	39.88
	Specialist	48	27.75
	Doctorate	7	4.05

Perceptions of Forestry and Natural Resources Curriculum for Secondary SBAE Teachers

Participants were asked to rate 26 items based on the Georgia Basic Agriscience and Technology curriculum standards using interval measurement scale.

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 2. 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 2

Perceived Importance of Natural Resources Curriculum

Content Statement	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 3. 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 3

Perceived Importance of Forest Science Concepts

Content Statement	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 4. 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 4

Perceived Importance of Wildlife Management Concepts

Content Statement	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.

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 5. 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 5

Perceived Competence of Natural Resource Management Concepts

Content Statement	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 6. 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 6

Perceived Competence of Forest Science Concepts

Content Statement	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 7. 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", and "teaching about careers in the wildlife management industry" (*M* = 3.74)."

Table 7

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.

An independent samples t-test was used to compare Georgia male and female SBAE teachers (Table 8). *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) in the forestry/natural resource pathways.

Table 8

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

	Male		*Female*		
Construct Areas	*M*	*SD*	*M*	*SD*	*Sig*
Natural Resource Management	0.90	2.76	2.59	2.30	0.01*
Forest Science	1.15	3.17	2.78	3.53	0.02*
Wildlife Management	1.05	3.20	2.77	3.52	0.01*
ALL	1.04	2.70	2.71	3.03	0.01*

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

Years of teaching experience (Table 9) were organized into five categories: one-five years, six-ten years, 11-15 years, 16-20 year, and 20 years or more. Teachers with one to five years of teaching experience had the highest training needs in forestry/natural resources concepts based on MWDS.

Table 9

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 (Table 10) was conducted to determine if there was a statistically significant difference between groups, years of experience. There was a significant difference between years of experience and *MWDS* from the forestry/natural items ($F_{4,168}$= 6.84, $p < .01$).

Table 10

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

Construct	*df*	*MS*	*F*	*Sig*
Natural Resource Management				
Between Groups	4	32.84	4.00	0.04*
Within Groups	168	8.21		
Total	172			
Forest Science				
Between Groups	4	70.70	6.935	0.01*
Within Groups	168	10.19		

Total	172			
Wildlife Management				
Between Groups	4	58.21	5.478	0.01*
Within Groups	168	10.62		
Total	172			
ALL				
Between Groups	4	52.35	6.84	0.01*
Within Groups	168			
Total	172			

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 one-five years of experience and 11-15 years of experience ($p < .01$), between teachers with one-five years of experience and 16-20 years of experience ($p < .01$), between teachers with one-five years of experience and 20 or more years of experience ($p < .01$), between teachers with 6-10 years of experience and 11-15 years of experience ($p < .01$), and between teachers with 6-10 years of experience and 16-20 years of experience ($p = .016$). No significant differences were reported between teachers having one-five 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 ($p = .600$). Teachers with one-five years of teaching experience showed the highest *MWDS* scores while teachers with 11-15 years of teaching experience displayed the lowest *MWDS.* A between-subjects ANOVA was calculated to determine if a statistically significant difference between the three regions (Table 11) in Georgia was present.

Table 11

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).

A significant difference (Table 12) was reported between forestry science and Georgia agricultural education regions ($F_{2,170} = 4.91$, $p < .01$).

Table 12

Analysis of Variance between Forestry/Natural Resource MWDS and Region

Construct	*df*	*MS*	*F*	*Sig*
Natural Resource Management				
Between Groups	2	21.07	2.44	0.09

Within Groups	170	8.64		
Total	172			
Forest Science				
Between Groups	2	78.50	7.25	0.01*
Within Groups	170	10.82		
Total	172			
Wildlife Management				
Between Groups	2	34.77	3.03	0.05
Within Groups	170	11.46		
Total	172			
ALL				
Between Groups	2	41.40	4.98	0.08
Within Groups	170	8.31		
Total	172			

To understand whether statistically significant differences existed between Georgia the LSD post hoc test was conducted in the agriculture education regions 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 ($p = .25$) or the central and south region ($p = .09$). 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).

A between-subjects ANOVA (Table 13) was conducted 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 ($F_{2,170} = 2.73$, $p > .05$).

Table 13

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

Construct	*df*	*MS*	*F*	*Sig*
Natural Resource Management				
Between Groups	2	14.79	1.70	0.19
Within Groups	170	8.72		
Total	172			
Forest Science				
Between Groups	2	33.18	2.92	0.06
Within Groups	170	11.35		
Total	172			
Wildlife Management				
Between Groups	2	28.11	2.44	0.09
Within Groups	170	11.54		
Total	172			
ALL				
Between Groups	2	23.31	2.73	0.07
Within Groups	170	8.52		
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 labeled as "none of these." Due to unequal sample sizes, responses were categorized by having career experience in natural resource management, forestry, and/or wildlife management and not having any career experience in natural resource management, forestry, and/or wildlife management.

Conclusions, Implications, and Recommendations

The purpose of this study was to determine teacher perceptions of forestry/natural resources curriculum to investigate internal barriers teachers may experience. The population for this study consisted of 173 secondary agriculture teachers (n = 173). The research questions of this study were analyzed by Mean Weighted Discrepancy Scores (*MWDS*) and various personal characteristics such as age, years of experience, gender, teaching backgrounds, and ethnicity.

Research question one identified the personal characteristics of high school agricultural education teachers in Georgia. The findings of this study suggested that not all teachers are engaged in the forestry/natural resource pathway. Many instructors 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.

Proper planning could also aid in the confidence for teachers with less than 5 years teaching experience. The findings of this study support Langley et al. (2014) recommendations for the development of novice teacher mentoring programs. 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.

Research question two addressed perceived levels 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 the most important concept within each of the three sections. The means for perceived importance are essential because they contribute to the overall *MWDS* and the conclusions regarding forestry/natural resources curriculum needs. 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. The inclusion of forestry specialists should involve school visits and field trips to explore the forest and natural resource industry. This would not only open student's perspectives but give instructors an improved sense of importance. Including professional organizations, federal agencies, business and industry groups, and schools or colleges of forestry could aid in the development of professional partnerships between the local program and the industry.

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

Research question three addressed 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. 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).

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.

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