



## Program of Study Justifications for Agriculture, Food, & Natural Resources

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### Agricultural Engineering and Applied Technologies



2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Agricultural Engineering and Applied Technologies</b>	Agriscience (5957)	Agricultural Mechanics and Maintenance (5944)	Agricultural Power and Technology (5945)	Agricultural and Biosystems Engineering (5963)
	Supervised Agricultural Experience (5964)			

### Description

Agricultural engineering and applied technologies program of study prepares students for careers or further study in engineering, environmental science, agricultural design and research, and agricultural mechanics. The program of study content covers navigation, maintenance, repair, and overhaul of electrical motors, hydraulic systems, and fuel-powered engines with special emphasis given to geographic information systems (GIS) and global positioning systems (GPS) applications to achieve various agricultural goals. Upon completion of this program of study, students will be prepared for immediate application of these skills in a career setting or pursue further study at the postsecondary level.

Students can gain job experience while in high school through *supervised agricultural experience (SAE) program or work-based learning*. Supervised agricultural experience is a structured experiential learning opportunity for Agriculture, Food, and Natural Resources (AFNR) students that takes place in a setting outside of regular school hours. This allows students to experience the diversity of agriculture, food, and natural resources industries and to gain exposure to agricultural-related career pathways.

### Job Outlook

Implementation of the *Governor's Rural Challenge: A 10-Year Strategic Plan* focuses on growth and prosperity of agriculture and forestry industry over the next decade. Education and workforce preparedness were the two major

focus areas addressed by the strategic plan. The skillsets for agricultural jobs are more complex and have an increased focus on technology.<sup>1</sup>

Production agriculture continues to be a dominant factor in our state’s landscape with over 68,000 farms producing and selling crops, livestock, forest productions, and manufactured or processed agricultural products.<sup>2</sup> All which depends on skilled workers from this program of study area to help produce, harvest, equip, repair, distribute, and process the products as efficiently and safely as possible using current technologies.

A majority of the jobs associated within agricultural engineering and applied technologies program of study average ranges from six to 18 percent as shown in Agricultural equipment operators have demands in the rural and/or production the state as illustrated in Figure 1.

Agricultural engineers and precision agriculture occupations which includes application of geographic information (GIS) and global positioning systems (GPS)

show up in Table 2 as either confidential or not available for Tennessee employment data but does show a 10 percent positive increase or 70,400 jobs in the US by the year 2022.<sup>3</sup>

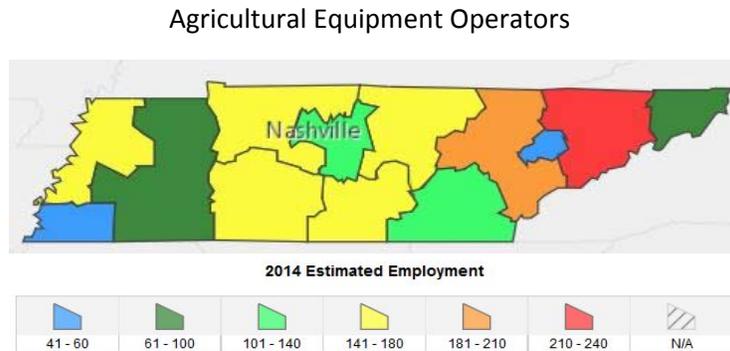


Figure 1

the growth Figure 2. the largest areas of

systems technology

Figure 2.

Occupation	2012	2022	Change	Annual Job Openings
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<sup>1</sup> Tennessee Department of Agriculture. (2014). *Tennessee Agriculture 2014, Departmental Report and Statistical Summary*, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>.

<sup>2</sup> Tennessee Department of Agriculture. (2014). *Tennessee Agriculture 2014, Departmental Report and Statistical Summary*, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>

<sup>3</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.



<b>Agricultural engineers and precision agriculture</b>	Confidential	Confidential	Confidential	Confidential
<b>Farm equipment mechanics and service technicians</b>	780	830	6%	30
<b>Maintenance and repair workers, general</b>	28,57a	31,570	11%	850
<b>Sales representatives, wholesale and manufacturing, except technical and scientific products</b>	24,210	26,240	8%	680
<b>Agricultural equipment operators</b>	1,300	1,530	18%	60
<b>Parts salespersons</b>	5,450	5,840	7%	180
<b>Career and technical education teachers, secondary school</b>	3,160	3,540	12%	130
<b>Engineering technicians, except drafters, all other</b>	610	670	10%	20

Tennessee’s robust agricultural production alone, excluding forest products, generates approximately \$2.5 billion annually in farm cash receipts.<sup>4</sup> The agro-forestry industry employed over 363,500 people or 10.3 percent of the state’s total workers.<sup>5</sup> This economic and employment impact provides the justification for the need to increase the scope and depth for a skilled and educated workforce within the AEAT program of study.

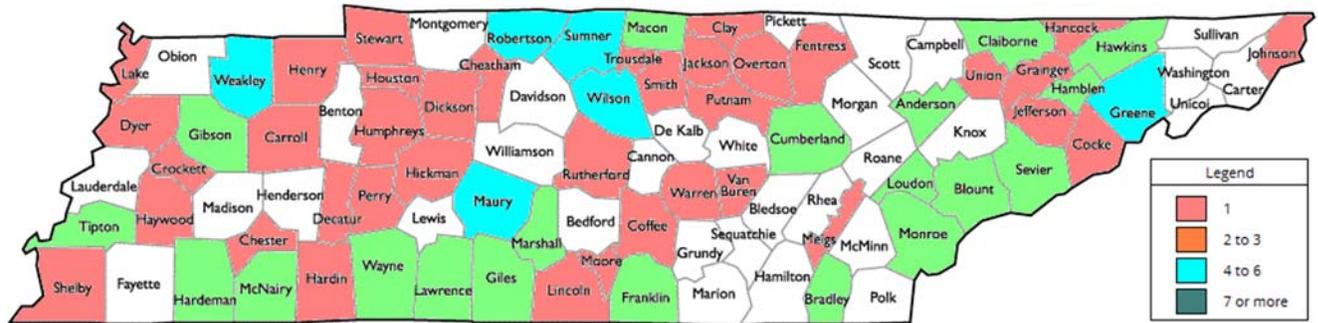
### ***Current Secondary Landscape***

The agricultural engineering and applied technologies program of study has increased to 106 programs with a 13 percent increase in student enrollment over the past three years. This program of study is the third largest enrollment of all the programs of study with 8,200 students enrolled in 106 programs during the 2014-15 school year. Open projections for the 2016-17 school year indicate that 8,453 students based on a three percent increase will be enrolled in one of the 109 (increase of three), for the 2016-17 school year. Figure 3 shows that distribution of agricultural engineering and applied technologies program of study.

<sup>4</sup> Tennessee Department of Economic and Community Development, Industries, Food & Agribusiness. HomeGrown. World Famous. Accessed Feb. 10, 2016 at <http://www.tnecd.com/industries/food-agribusiness/>

<sup>5</sup> Tennessee Department of Agriculture. (2016). Economic Impacts of Tennessee Agriculture and Forestry. Retrieved from <http://www.tn.gov/agriculture/article/ag-eac-economic-impact>.

**Figure 3.**



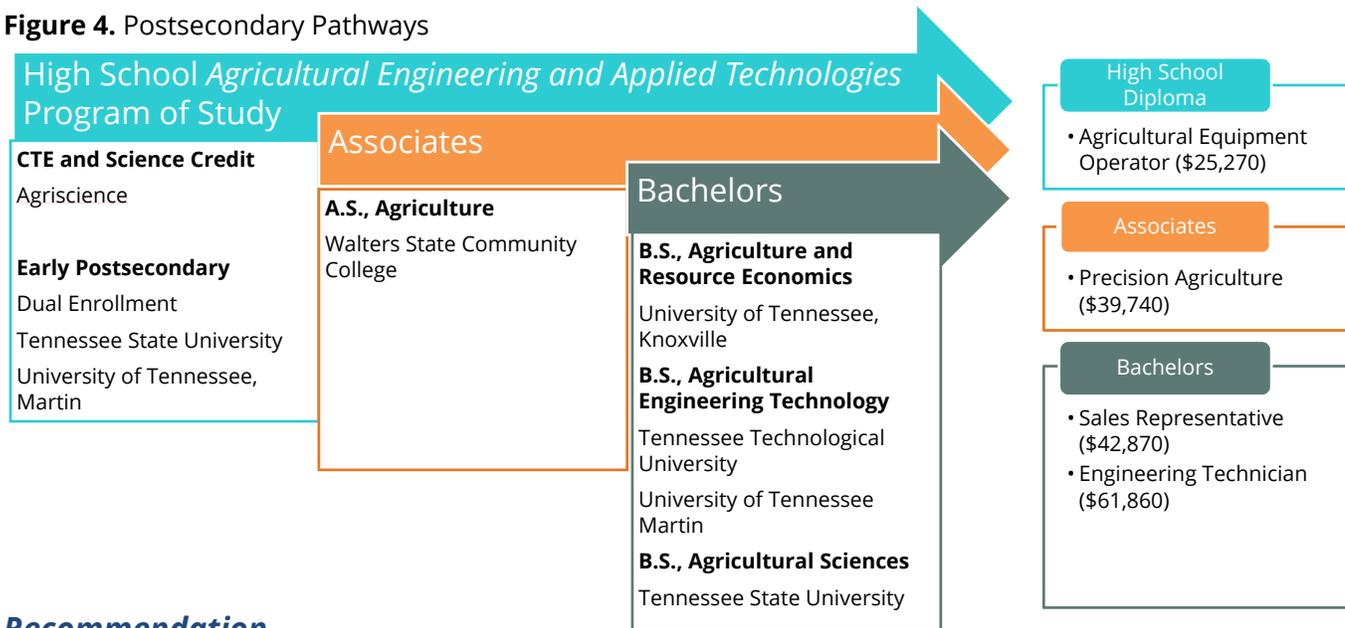
The agricultural engineering and applied technologies program of study implemented revised standards the fall of 2014 to align with the Governor’s Rural Challenge to advance the focus on STEM technologies and to increase the scope and depth of a skilled and educated workforce for the agriculture industry. Incorporation of geographic information systems (GIS), global positioning systems (GPS), and Unmanned Aerial Systems throughout this program of study has allowed the preparation of students to enter new growing highly technical areas of the agriculture industry. Dual enrollment opportunities help ensure the rigor and bridge the gap to additional postsecondary training for additional credentialing.

### **Postsecondary Pathways**

Agricultural engineering and applied technologies program of study provides a wide range of career opportunities that links to each of the agriculture, food, and natural resources program of studies and each postsecondary pathway. Figure 2 below illustrates what one such pathway might look like for a student graduating from an agricultural engineering and applied technologies program of study in high school. Annual median wages are based on Bureau of Labor Statistics Occupational Employment Statistics from O Net OnLine estimates for Tennessee, unless otherwise indicated.

Upon completion of this program of study, students will be prepared to pursue further study in a variety of agricultural engineering and applied technologies certificates and degrees at the postsecondary level. Specifically, students will be prepared to major in one or more of the following areas: biosystems engineering, environmental and soil science, biosystems technology, or agricultural engineering technologies. Pursuing just an additional year or two of study beyond high school can yield great returns for students. Typically, a farm equipment mechanic will enter at a higher salary where career/technical education teachers, secondary school and engineering technicians, except drafters must have at least a four year degree.

**Figure 4.** Postsecondary Pathways



**Recommendation**

Recent revisions to the agricultural engineering and applied technologies program of study in the agriculture, food, and natural resources career cluster as approved by the Tennessee State Board of Education in January 2014, were strong steps in preparing a student for entry level employment, early postsecondary experience opportunities, and postsecondary transition. Another strong feature of this program of study was the incorporation of the water control, irrigation management, and geographical informational system technology. Increased industry partnerships will be vital to provide the high level technical skills within these new focus areas. No recommended changes at this time.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Agricultural Engineering and Applied Technologies</b>	Agriscience (5957)	Principles of Agricultural Mechanics (5944)	Agricultural Power and Equipment (5945) -or- <b>Dual Enrollment</b> Agricultural Engineering & Applied Technologies (4066)	Agricultural and Biosystems Engineering (5963) -or- <b>Dual Enrollment</b> Agricultural Engineering & Applied Technologies (4066)
	Supervised Agricultural Experience (5964)			

## **References**

National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.

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# Agribusiness

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Agribusiness</b>	Agriscience (5957)	Principles of Agribusiness (5946)	Organizational Leadership and Communications (5956)	Agricultural Business and Finance <sup>2</sup> (5943) -or- Statewide Dual Credit Introduction to Agribusiness <sup>2</sup> (4270)
	Supervised Agricultural Experience (5964)			

## Description

The Agribusiness program of study teaches students to apply the economic and business principles involved in the sale and supply of agricultural products to a wide range of careers across the industry. In addition to building foundational knowledge of finance and marketing principles as they apply to agricultural businesses, courses, in this program of study teach students essential leadership, management, and communication skills to help them succeed in future agribusiness careers. The program of study allows the student to satisfy science and personal finance credit required for graduation and earn postsecondary credit while developing the knowledge and skills within the program of study. Upon completion of this program of study, students will also be prepared for advanced business courses at the postsecondary level.

Students can gain job experience while in high school through supervised agricultural experience (SAE) program or work-based learning. Supervised agricultural experience is a structured experiential learning opportunity for Agriculture, Food, and Natural Resources (AFNR) students that takes place in a setting outside of regular school hours. This allows students to experience the diversity of agriculture, food, and natural resources industries and to gain exposure to agricultural-related career pathways.

## Job Outlook

According to the United States Department of Agriculture’s National Institute of Food and Agriculture report and Purdue University, there are nearly 60,000 high-skilled agriculture job openings expected annually in the U.S. Yet, only 35,000 graduates are available to fill them. These jobs will only become more important as we continue to develop solutions to feed more than 9 billion people by 2050. The report projects almost half of the job opportunities will be in management and business.<sup>6</sup>

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<sup>6</sup> United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/management-business>.

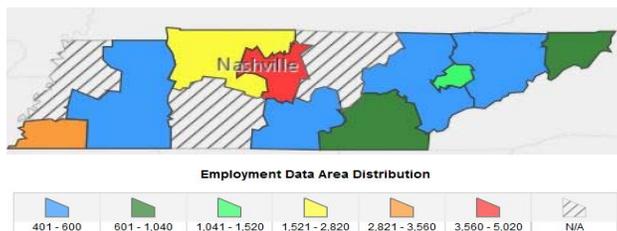
Implementation of the *Governor's Rural Challenge: A 10-Year Strategic Plan* focuses on growth and prosperity of agriculture and forestry industry over the next decade. Education and workforce preparedness were the two major focus areas addressed by the strategic plan. The skillsets for agricultural jobs are more complex and have an increased focus on technology.<sup>7</sup>

The agribusiness program of study provides a wider range of career opportunities that links to each of the agriculture, food, and natural resources programs of studies, each postsecondary pathway and to several business careers. As consumers purchase more fresh foods and build houses the need for individuals with related purchasing, marketing strategies, and management opportunities will increase.<sup>8</sup>

**Figure 2** shows only a small variety of career opportunities from a loan officer to a financial manager with 160 to 400 annual openings respectively requiring a bachelor's degree.<sup>9</sup> Sales representatives, wholesales and manufacturing, technical and scientific product occupations become more abundant outside of the rural production areas as shown in **Figure 1**, but remains strong for this program of study.<sup>10</sup>

**Figure 1**

Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products Projected Employment



<sup>7</sup> Tennessee Department of Agriculture. (2014). Tennessee Agriculture 2014, Departmental Report and Statistical Summary, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>.

<sup>8</sup> United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/management-business>.

<sup>9</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>

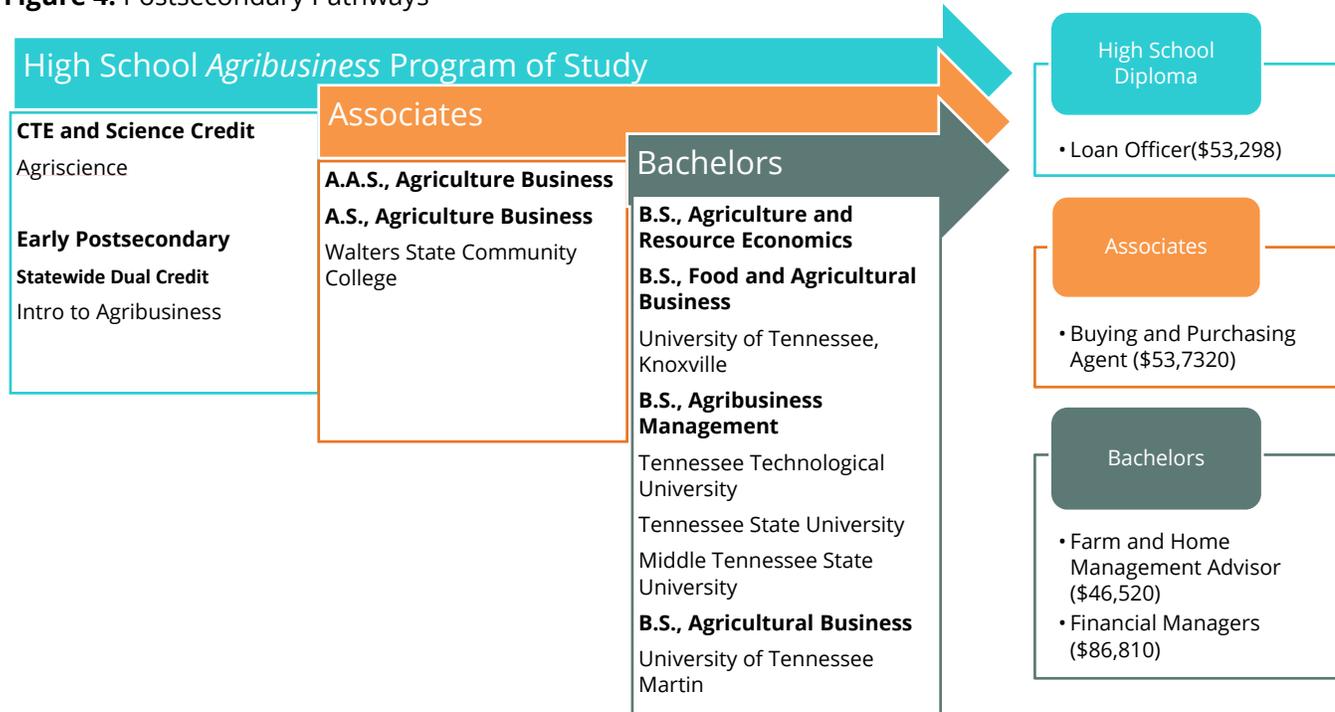
<sup>10</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.



## Postsecondary Pathways

Agribusiness provides the broadest range of career opportunities that links to each of the agriculture, food, and natural resources programs of studies and each postsecondary pathway. **Figure 4** below illustrates what one such pathway might look like for a student graduating from an Agribusiness program of study in high school. Annual median starting wages are based on Bureau of Labor Statistics Occupational Employment Statistics from O\*Net OnLine estimates for Tennessee, unless otherwise indicated:<sup>13</sup>

**Figure 4.** Postsecondary Pathways



Upon completion of the agribusiness program of study, students will be prepared to pursue further study in a variety of agribusiness degrees at the postsecondary level. Specifically, students will be prepared to major in one or more of the following areas: agricultural and resource economics, food and agricultural business, agricultural equipment systems management, natural resource & environmental economics, agribusiness management and agricultural business. Pursuing just an additional year or two of study beyond high school can yield great returns for students. Typically, a loan officer will enter at a higher salary where the farm and home management advisor must have at least a four year degree.<sup>14</sup>

<sup>13</sup>National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>

<sup>14</sup>National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.

## Recommendation

No recommended changes at this time.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Agribusiness</b>	Agriscience (5957)	Principles of Agribusiness (5946)	Organizational Leadership and Communications (5956) -or- <b>Dual Enrollment</b> Agribusiness (4067)	Agricultural Business and Finance <sup>2</sup> (5943) -or- <b>Statewide Dual Credit</b> Intro to Agribusiness (4270) -or- <b>Dual Enrollment</b> Agribusiness (4067)
	Supervised Agricultural Experience (5964)			

## References

National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>

Tennessee Department of Agriculture (2013), *Governor's Rural Challenge: A 10-Year Strategic Plan, December 2013*. Retrieved from <http://www.tn.gov/agriculture/publications/ruralchallenge/AgReport.pdf>.

Tennessee Department of Agriculture. (2014). Tennessee Agriculture 2014, Departmental Report and Statistical Summary, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>.

Tennessee Department of Agriculture. (2016). Economic Impacts of Tennessee Agriculture and Forestry. Retrieved from <http://www.tn.gov/agriculture/article/ag-eac-economic-impact>.

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United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/management-business>.

## Environmental and Natural Resource Management

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Program of Study Courses</b>	Agriscience (5957)	Applied Environmental Science <sup>1</sup> (6114)	Plant and Soil Science (5950)	Natural Resource Management <sup>2</sup> (6117) or AP Environmental Science (3236)
	Supervised Agricultural Experience (5964)			

### Description

Environmental and natural resource management program of study is designed for students interested in learning more about becoming good stewards of our environment and natural resources, as an environmental scientist, conservationist, forester, or wildlife manager. This program of study covers environmental impacts, energy consumption, environmental public policy, and fundamental science and management of ecosystems, with special attention given to current agricultural practices that support the healthy and sustainable cultivation of major crops. Students will earn science credit required for graduation while developing the knowledge and skills of this program of study. Upon completion of this program of study, students will be prepared for a range of careers or transition to postsecondary pathways associated with the environmental science, science and management of plants, soils, wildlife, and natural resources.

Students can gain job experience while in high school through *supervised agricultural experience* (SAE) program or *work-based learning*. Supervised agricultural experience is a structured experiential learning opportunity for agriculture, food, and natural resources students that takes place in a setting outside of regular school hours. This allows students to experience the diversity of agriculture, food, and natural resources industries and to gain exposure to agricultural-related career pathways.

### Job Outlook

Implementation of the *Governor's Rural Challenge: A 10-Year Strategic Plan* focuses on growth and prosperity of agriculture and forestry industry over the next decade. Education and workforce preparedness were the two major focus areas addressed by the strategic plan. The skillsets for agricultural jobs are more complex and have an increased focus on technology.<sup>15</sup>

<sup>15</sup> Tennessee Department of Agriculture (2013), *Governor's Rural Challenge: A 10-Year Strategic Plan*, December 2013. Retrieved from <http://www.tn.gov/agriculture/publications/ruralchallenge/AgReport.pdf>.

Tennessee's robust agricultural production alone, excluding forest products, generates approximately \$2.5 billion annually in farm cash receipts.<sup>16</sup> The agro-forestry industry employed over 363,500 people or 10.3 percent of the state's total workers.<sup>17</sup> This economic and employment impact provides the foundation for need of skilled workers within the environmental and natural resource management program of study to maintain safe environments that are required for wholesome food, water, and recreational areas.

The Tennessee Department of Agriculture is working with the University of Tennessee Institute of Agriculture and Tennessee Department of Environment and Conservation on environmental research initiatives for Tennessee Agriculture. This includes identifying water issues and needs throughout the state.<sup>18</sup> These research initiatives and water issues and needs will require new skills and technologies such as geographic information systems (GIS) and global positioning systems (GPS) technologies.

According to the Tennessee Department of Environment and Conservation, Tennessee needs employees with diverse and dynamic skill sets to continue safeguarding the health and safety of Tennessee citizens from environmental hazards, protecting and improving the quality of Tennessee's land, air and water, and by managing the Tennessee State Parks system.<sup>19</sup> This along with the increased need from the Governor's Rural Challenge will stimulate job creation in the environmental and natural resource area.

The United States Department of Agriculture recently released an employment impact report showing nearly 60,000 high-skilled annual job openings between 2015 and 2020 in the food, agriculture, renewable natural resources, and environment fields with only an average of 35,000 new college graduates each year. They predict to expect a strong employment market for ecosystems managers, agricultural science and business educators, crop advisors, and pest control specialist. Expect the strongest job market for plant scientists, sustainable biomaterials specialist, water resources scientists, and engineers and precision agriculture specialist.<sup>20</sup>

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<sup>16</sup> Tennessee Department of Economic and Community Development, Industries, Food & Agribusiness. HomeGrown. World Famous. Accessed Feb. 10, 2016 at <http://www.tnecd.com/industries/food-agribusiness/>

<sup>17</sup> Tennessee Department of Agriculture (TDOA), Economic Impacts of Tennessee Agriculture and Forestry, Available at <http://www.tn.gov/agriculture/article/ag-eac-economic-impact>. Accessed Feb. 2016.

<sup>18</sup> Tennessee Department of Agriculture (TDOA), *Governor's Rural Challenge: 2014 Progress Report*, Available at [http://www.tn.gov/agriculture/general/2014grc\\_progress.pdf](http://www.tn.gov/agriculture/general/2014grc_progress.pdf). Accessed Feb. 2015.

<sup>19</sup> Tennessee Department of Labor and Workforce Development, Employment Security Division, Labor Market Information Section, Occupational Data Unit. *Tennessee Supply and Demand Analysis for the 16 Education Clusters*, July 11, 2012. Available at [http://www.doleta.gov/performance/results/AnnualReports/2011\\_economic\\_reports/tn\\_supplyand\\_demand.pdf](http://www.doleta.gov/performance/results/AnnualReports/2011_economic_reports/tn_supplyand_demand.pdf). Accessed Feb. 2015.

<sup>20</sup> United States Department of Agriculture. (2015). *Employment Opportunities 2015-2020*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved March 2016, from <https://www.purdue.edu/usda/employment>

**Figure 1** shows that Environmental scientists and specialists are expected to grow 11 percent or 10,200 jobs from 2014-2024, faster than the average for all occupations.<sup>21</sup> Scientists need at least a bachelor’s degree in natural science for entry level positions. Recreational workers employment rate is expected to grow 10 percent or 38,900 jobs from 2014-2024, as fast as the average for all occupations. Educational requirements vary, but many workers must have a bachelor’s degree in a related field.<sup>22</sup>

Environmental engineers, occupational health and safety specialist, and environmental science and protection technicians are three career areas starting to experience the impact from the United States Department of Agriculture projections. Currently, these three occupational areas are considered as a bright statewide outlook according to JOBS4TN ONLINE.<sup>23</sup>

**Figure 1.**

Occupation	2012	2022	Change	Annual Job Openings
Compliance officers	3,950	4,410	12%	120
Environmental engineers	990	1,200	21%	50
Environmental scientists and specialists, including health	1,350	1,430	6%	50
First-Line supervisors of farming, fishing, and forestry workers	980	1,040	7%	30
Mechanical engineering technicians	860	990	16%	30
Occupational health and safety specialists	1,450	1,530	5%	50
Occupational health and safety technicians	330	340	4%	10
Pest control worker	2,000	2,600	30%	110
Recreation workers	4,650	5,330	15%	120
Water and wastewater treatment plant and system operators	2,160	2,400	11%	100

<sup>21</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Environmental Scientists and Specialists, Available at <http://www.bls.gov/ooh/life-physical-and-social-science/environmental-scientists-and-specialists.htm>. Published 2015. Accessed Feb. 2016.

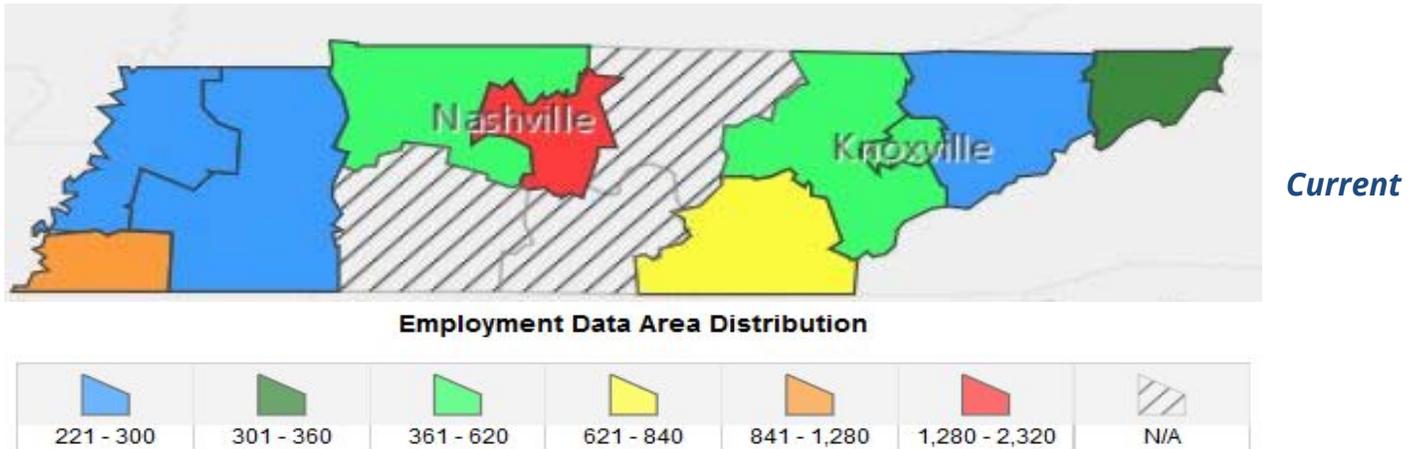
<sup>22</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Recreation Workers, Available at <http://www.bls.gov/ooh/personal-care-and-service/recreation-workers.htm>. Published 2012. Accessed Feb 2015.

<sup>23</sup> Tennessee Department of Labor and Workforce Development, Jobs4TN Online. (2016). Occupational Summary. Retrieved from

<https://www.jobs4tn.gov/vosnet/lmi/occ/occsummary.aspx?enc=yjZ5247G+UUou6iaabKU3D+wulFKjhE3klHhZcZG2Vd+MF9aZf5u9UuY/dgvePSu1ijCD4uki5/+g5ioa+rO2QL+LLN/V9oe16HUB6pzbv/Zgf5WZ1hw3ILV1eWclr1T3o+OA/RqlplYDHYOuYvpNRWviAK79P4iZr4acd+3g2orC7YMqvrYDfAq9537e7AAU1ocDSJNGQHiYP7oC2MCTA==>

Other occupations as represented in **Figure 1** are starting to see growth in urban and surrounding workforce regions as represented in **Figure 2** Tennessee Compliance Inspector Projected Employment, 2014.

**Figure 2.**

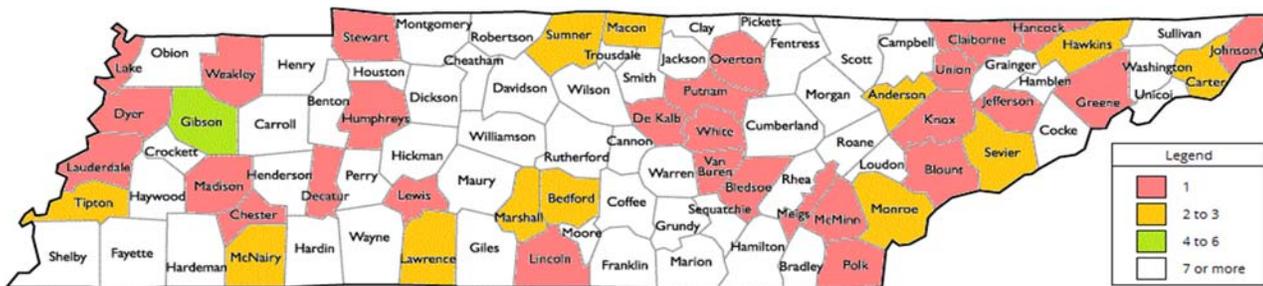


**Secondary Landscape**

The environmental and natural resources management program of study shows an enrollment of 4,151 students or 11 percent of the AFNR enrollment for the 2014-15 school year. With the restructuring and realignment of the content standards to increase the rigor and improve relevance to meet industry employment trends, enrollment declined 23 percent in 2014-15. In part, this decline was the renaming of the courses to better represent the course content taught at each level.

Open enrollment projections indicate growth is starting to rebound with a positive increase with 59 program of studies being offered in the 2016-17 school year as represented in **Figure 3**.<sup>24</sup>

**Figure 3.**



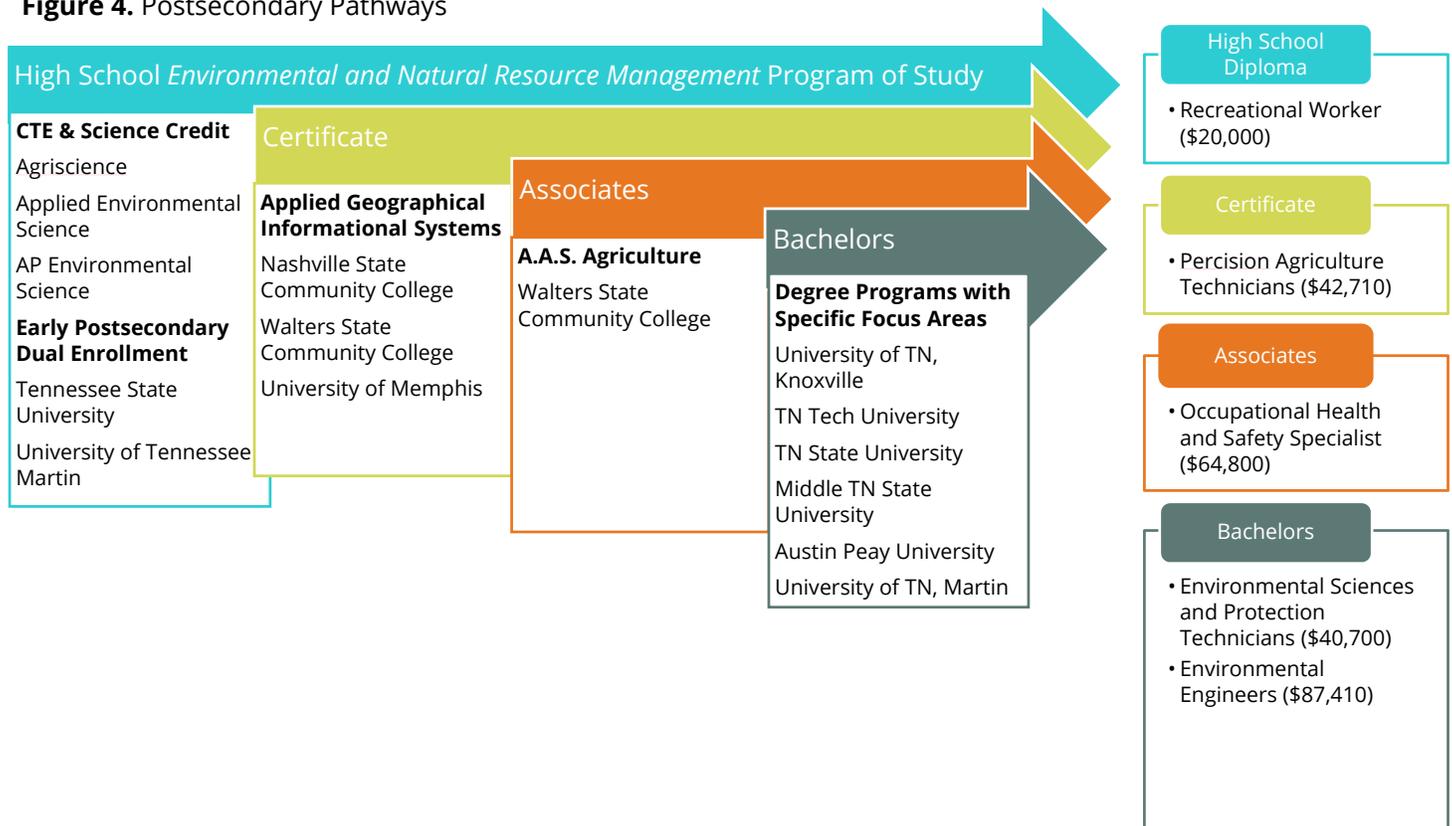
<sup>24</sup> Tennessee Department of Education. (2015). Student Enrollment Data. Retrieved from author's calculation of student enrollment data.

## Postsecondary Pathways

This program of study provides a wider range of career opportunities that links to each of the AFNR programs of studies and each agriculture and several environmental science postsecondary pathways. Annual median starting wages are based on Bureau of Labor Statistics Occupational Employment Statistics from O\*Net OnLine estimates for Tennessee, unless otherwise indicated:<sup>25</sup>

Upon completion of this program of study, students will be prepared to pursue further study in a variety of agricultural and environmental and natural resource degrees at the postsecondary level. Specifically, students will be prepared to major in one or more of the following areas: agricultural and resource economics, food and agricultural business, agricultural equipment systems management, natural resource and environmental economics, agribusiness management and agricultural business, wildlife management, biology, environmental science, and environmental engineering.

**Figure 4.** Postsecondary Pathways



<sup>25</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.

## Recommendation

No recommended changes at this time.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Environmental and Natural Resource Management</b>	Agriscience <sup>1</sup> (5957)	Applied Environmental Science <sup>1</sup> (6114)	Plant and Soil Science (5950) -or- <b>Dual Enrollment</b> Environmental & Natural Resources Management (4070)	Natural Resources Management (6117) -and/or- AP Environmental Science (3236) -or- <b>Dual Enrollment</b> Environmental & Natural Resources Management (4070)
	Supervised Agricultural Experience (5964)			

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# Food Science

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
Program of Study Courses	Agriscience (5957)	Principles of Food Production (6118)	Food Science and Safety (6115)	Advanced Food Science (6113)
	Supervised Agricultural Experience (5964)			

## Description

Food science program of study was first implemented with the 2014-15 school year. It is designed to introduce students to the growing fields of food science and technology. Content covered in this program of study includes plant and animal structural anatomy, systems physiology, economics of production, genetics and biotechnology, and other management approaches associated with plant and animal production. Advanced courses explore food safety and sanitation, foodborne pathogens, food-related standards and regulations, characteristics and properties of food products, processing and grading techniques and skills, and food labeling and packaging. Upon completion of the food science program of study, students will be equipped with the technical knowledge and skills necessary for further education and careers in areas of food science.

Students can gain job experience while in high school through supervised agricultural experience (SAE) program or work-based learning. Supervised agricultural experience is a structured experiential learning opportunity for agriculture, food, and natural resources students that takes place in a setting outside of regular school hours. This allows students to experience the diversity of agriculture, food, and natural resources industries and to gain exposure to agricultural-related career pathways.

## Job Outlook

Implementation of the *Governor's Rural Challenge: A 10-Year Strategic Plan* focuses on growth and prosperity of agriculture and forestry industry over the next decade. Education and workforce preparedness were the two major focus areas addressed by the strategic plan. The skillsets for agricultural jobs are more complex and have an increased focus on technology.<sup>26</sup>

Tennessee's robust agricultural production alone, excluding forest products, generates approximately \$2.5 billion annually in farm cash receipts.<sup>27</sup> The agro-forestry industry employed over 363,500 people or 10.3 percent of the state's total workers.<sup>28</sup> This economic and employment impact provides the justification for the need for skilled

<sup>26</sup> Tennessee Department of Agriculture (2013), *Governor's Rural Challenge: A 10-Year Strategic Plan, December 2013*. Retrieved from <http://www.tn.gov/agriculture/publications/ruralchallenge/AgReport.pdf>.

<sup>27</sup> Tennessee Department of Economic and Community Development, Industries, Food & Agribusiness. HomeGrown. World Famous. Accessed Feb. 10, 2016 at <http://www.tnecd.com/industries/food-agribusiness/>

<sup>28</sup> Tennessee Department of Agriculture (TDOA), Economic Impacts of Tennessee Agriculture and Forestry, Available at <http://www.tn.gov/agriculture/article/ag-eac-economic-impact>. Accessed Feb. 2016.

workers within the food science program of study to maintain safety and the wholesomeness of animal and plant food products, reducing the public's risk of contracting food borne illnesses.

Tennessee has a robust agricultural industry that supplies vendors and products around the globe. This strong agricultural economy accounts for 10.5 percent of Tennessee's economy while generating over \$51.4 billion in output. This has been the results of quality well known food brands such as M&M Mars, Bush Beans, Moon Pies, Tyson Foods, Coca-Cola, Green Mountain Coffee, and Unilever. Tennessee is actively supporting growth in the food and beverage sector with plans to develop over 4,000 new jobs.<sup>29</sup>

While the number of large farms will decrease, more producers will be growing fresh fruits, vegetables and organic crops located near cities and metropolitan areas. This will drive the demand for a variety of industry related jobs as listed below in **Figure 1** with a strong increase in certified crop advisors, food production consultants, pest control specialist<sup>30</sup>, and production managers for poultry and swine.<sup>31</sup> To meet the new demands associated with these new jobs, development of a high skilled workforce with technical food science skills will be vital to meet local, state, national and world market needs to feed 9 million people by 2050<sup>32</sup>. Tennessee labor market data reflects the demand increase near cities and metropolitan areas as shown in **Figure 2** and **Figure 3** for crop farmworkers, labors, graders and sorters of agricultural products.

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<sup>29</sup> Tennessee Department of Economic and Community Development, Industries, Food & Agribusiness. HomeGrown. World Famous. Accessed Feb. 10, 2015 at <http://www.tnecd.com/industries/food-agribusiness/>

<sup>30</sup> United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/management-business>.

<sup>31</sup> United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/science-and-engineering/>

<sup>32</sup> United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/management-business>.

Figure 1.

Occupation	2012	2022	Change	Annual Job Openings
<b>Pest control workers</b>	2,000	2,600	30%	110
<b>Meat, poultry, and fish cutters and trimmers</b>	2,970	3,050	3%	80
<b>Graders and sorters, agricultural products</b>	1,100	1,190	8%	30
<b>Food scientists and technologists</b>	680	630	-7%	20
<b>Food science technicians</b>	560	550	-1%	20
<b>First-Line supervisors of office and administrative support workers</b>	31,710	36,940	17%	1,280
<b>First-Line supervisors of farming, fishing, and forestry workers (animal and plant)</b>	980	1,040	7%	30
<b>Computer user support specialists</b>	6,940	8,390	21%	250
<b>Butchers and meat cutters</b>	2,610	2,740	5%	80
<b>Farmworkers and laborers, crop</b>	14,720	15,720	7%	550

Figure 2.

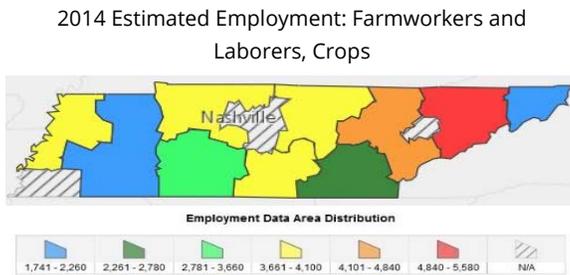
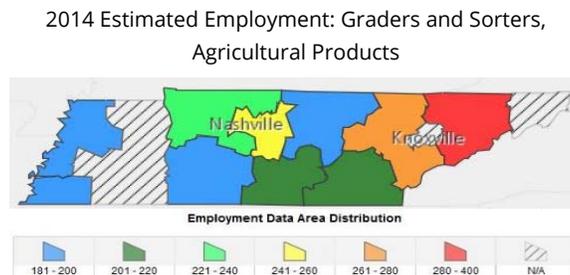


Figure 3.



**Current Secondary Outlook**  
The food science program of projected to

study now in its second year of existence is have a 69 percent (118 students) increase based on preliminary enrollment data for the 2015-16 school year. Open enrollment projections indicate that 1,000 students could be enrolled in 10 programs during the 2016-17 school year. This increase is reflected in **Figure 4**.<sup>33</sup>

<sup>33</sup> Tennessee Department of Education. (2015). Student Enrollment Data. Retrieved from author's calculation of student enrollment data.

Figure 4.



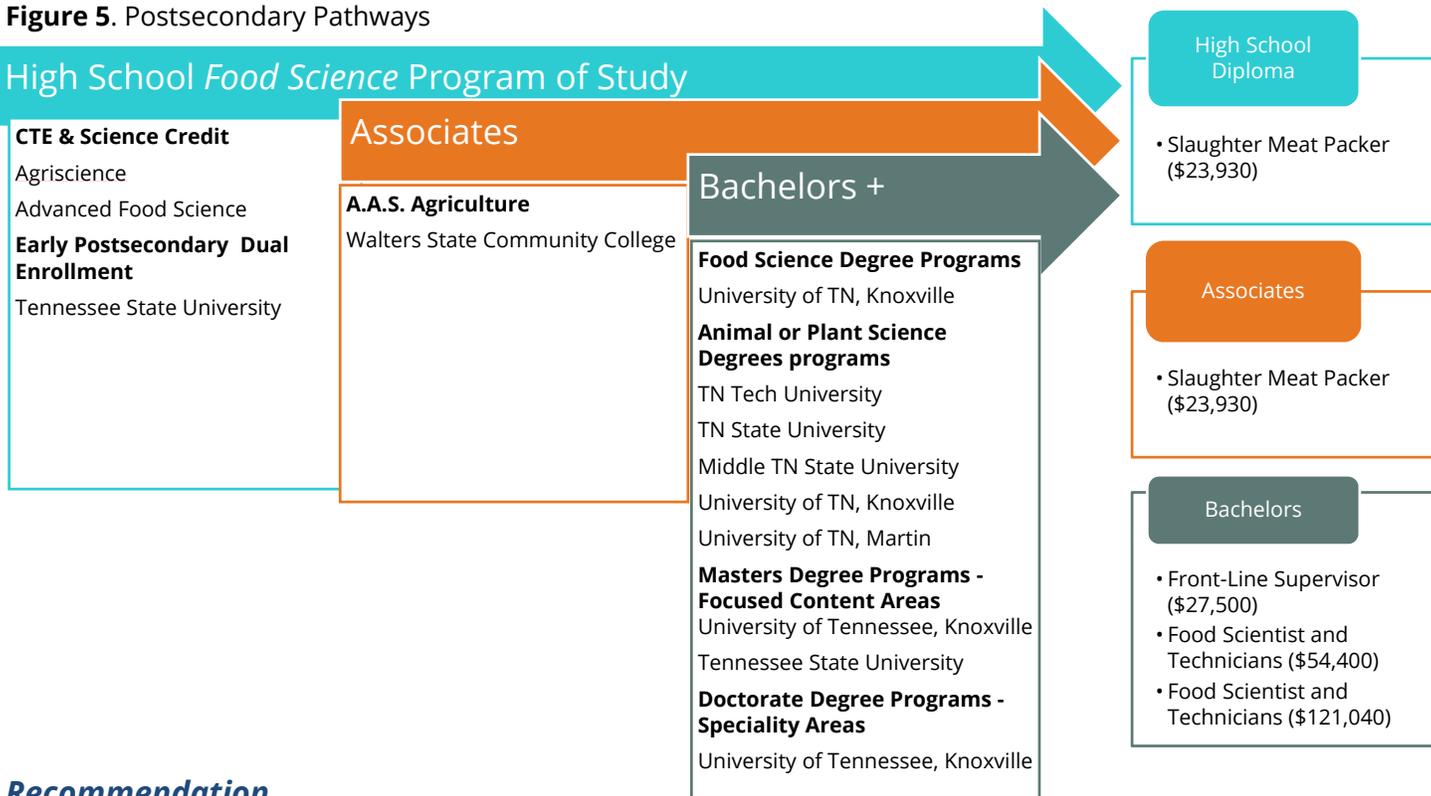
### Postsecondary Pathways

Food science program of study provides a wide range of career opportunities that link to several careers in each of the other agriculture, food, and natural resources program of studies and to multiple postsecondary pathways including food science and technology with options in pre-pharmacy, pre-professional, science concentration, technology, and business in addition to the related degrees of animal science, plant science, and agricultural business. According to a report published by the University of Tennessee, Food Science majors were the highest earning group with a median earning of \$65,000.<sup>34</sup> Obtaining a graduate degree will provide a 54 percent boost in earnings for Food Science majors earning a Masters or Doctoral degree. The graphic below illustrates what one such pathway might look like for a student graduating with a food science program of study in high school. Annual median starting wages are based on Bureau of Labor Statistics Occupational Employment Statistics from O\*Net OnLine estimates for Tennessee, unless otherwise indicated.<sup>35</sup>

<sup>34</sup> A. Carnevale, J. Strohl, and M. Melton, Georgetown University Center on Education and the Workforce at <https://ag.tennessee.edu/foodscience/Documents/agriculture-naturalresources.pdf> . Accessed Feb. 2015.

<sup>35</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.

**Figure 5.** Postsecondary Pathways



**Recommendation**

The approval for the food science program of study in the agriculture, food and natural resources career cluster by the Tennessee State Board of Education in January 2014, is aligned to provide a smooth transition to postsecondary education by providing a strong foundation for food production, safety, food chemistry and food commodities. Agriscience will help to advance the student's progress toward high school graduation and a degree at the postsecondary level. Based on the increased need for more producers of fresh fruits, vegetables, and organic crops located near cities and metropolitan areas, the demand for a variety of food science industry and related jobs will exceed the supply.

It is recommended that the food science program of study continue with no additional changes and the department for its part can encourage districts to apply for Perkins Reserve Grants and other sources of support to meet the startup cost for new food science programs of study to ensure LEA can meet local labor market needs.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Food Science</b>	Agriscience <sup>1</sup> (5957)	Principles of Food Production (6118)	Food Science and Safety (6115) -or- <b>Dual Enrollment</b> Food Science (4068)	Advanced Food Science (6113) -or- <b>Dual Enrollment</b> Food Science (4068)
	Supervised Agricultural Experience (5964)			

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# Horticulture Science

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Horticulture Science</b>	Agriscience (5957)	Principles of Plant Science and Hydroculture (6119)	Greenhouse Management (5954) or Statewide Dual Credit: Introduction to Plant Science (4269)	Landscaping and Turf Science (5951)
	Supervised Agricultural Experience (5964)			

## Description

Horticulture Science prepares students for future careers in the management of greenhouse operations, horticulture production, landscape design and maintenance, and turf management. Content covered in this program of study includes principles of plant health, growth, reproduction, and biotechnology, principles of hydroponics and aquaponics, greenhouse structures, growing media, site analysis and planning, principles of design, and plant selection and care techniques. The program of study allows the student to satisfy science credit required for graduation and earn postsecondary credit while developing the knowledge and skills within the program of study. Upon completion of this program of study, students will be prepared to pursue careers, sit for the Ornamental and Turf Commercial Pesticide License (03), and further study in the horticultural sciences at the postsecondary level.

Students can gain job experience while in high school through *supervised agricultural experience* (SAE) program or *work-based learning*. Supervised agricultural experience is a structured experiential learning opportunity for agriculture, food, and natural resources students that takes place in a setting outside of regular school hours. This allows students to experience the diversity of agriculture, food, and natural resources industries and to gain exposure to agricultural-related career pathways.

## Job Outlook

Implementation of the *Governor's Rural Challenge: A 10-Year Strategic Plan* focuses on growth and prosperity of agriculture and forestry industry over the next decade. Education and workforce preparedness were the two major focus areas addressed by the strategic plan. The skill sets for agricultural jobs are more complex and have an increased focus on technology.<sup>36</sup>

<sup>36</sup> Tennessee Department of Agriculture. (2014). Tennessee Agriculture 2014, Departmental Report and Statistical Summary, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>.

Tennessee’s robust agricultural production alone, excluding forest products, generates approximately \$2.5 billion annually in farm cash receipts.<sup>37</sup> The agro-forestry industry employed over 363,500 people or 10.3 percent of the state’s total workers.<sup>38</sup> This economic and employment impact provides the justification for the need for skilled workers within the Horticulture Science program of study.

The Horticulture program of study provides a wider range of career opportunities that links to each of the AFNR programs of studies, each postsecondary pathway and related career opportunities. As consumers purchase more fresh fruits, vegetables, and organic crops, and build houses, the need for individuals with landscape contracting and crop management as well as related purchasing, marketing strategies, and management opportunities will increase.<sup>39</sup>

**Figure 1** outlines the wide variety of career opportunities with large projected growth areas in Landscaping and Groundskeeping workers with a 19 percent change in annual openings from 2012 to 2020.<sup>40</sup> First-Line supervisors of landscaping, lawn service, and groundskeeping workers occupations remain strong for this program of study.<sup>41</sup>

**Figure 1.**

Occupation	2012	2020	Change	Annual Job Openings
Landscaping and groundskeeping workers	19,390	22,990	19%	850
Farmworkers and laborers, crop, nursery, and greenhouse	14,720	15,720	7%	550
First-Line supervisors of landscaping, lawn service, and groundskeeping workers	4,080	4,860	19%	120

Farmworkers and labors, crop, nursery, and greenhouse workers employment trends is experiencing more growth near urban areas as the desire for locally grown and farm to table trends increase as outlined in **Figure 2**.

<sup>37</sup> Tennessee Department of Economic and Community Development, Industries, Food & Agribusiness. HomeGrown. World Famous. Accessed Feb. 10, 2016 at <http://www.tnecd.com/industries/food-agribusiness/>

<sup>38</sup> Tennessee Department of Agriculture. (2016). Economic Impacts of Tennessee Agriculture and Forestry. Retrieved from <http://www.tn.gov/agriculture/article/ag-eac-economic-impact>.

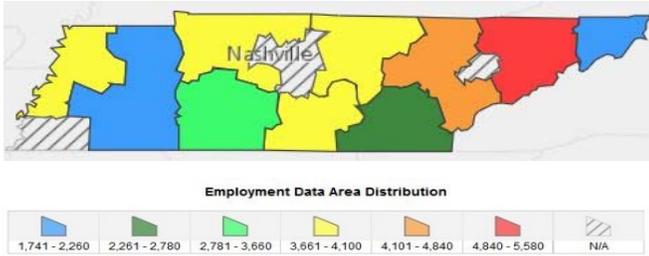
<sup>39</sup> United States Department of Agriculture. (2015). *Management and Business Trends and Forecast*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/management-business>.

<sup>40</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>

<sup>41</sup> National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.

**Figure 2.**

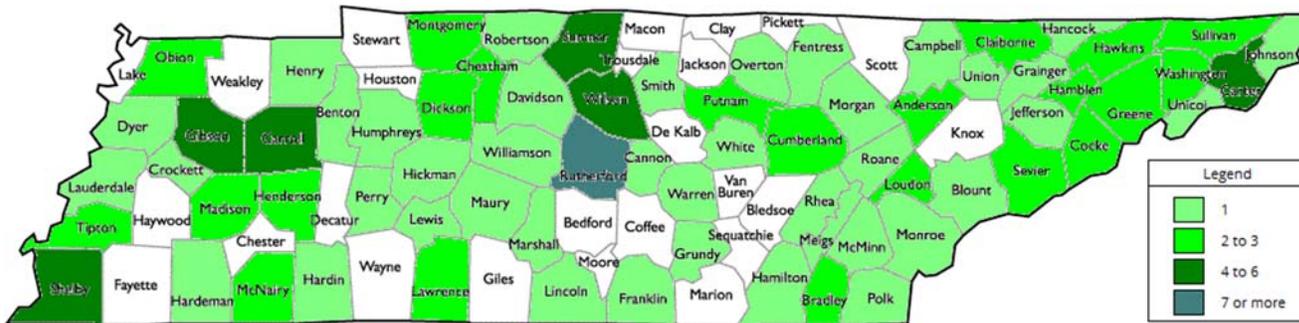
Farmworkers and Laborers, Crop, Nursery, and Greenhouse  
Projected Employment



### Current Secondary Landscape

Since the revision of the horticulture science program of study course standards in 2013, it remains the second most popular program of study and had with 13 percent enrollment growth over the past three years. 10,811 students were enrolled in 129 programs, **Figure 3**, during the 2014-15 school year.

**Figure 3.**



### Postsecondary Pathways

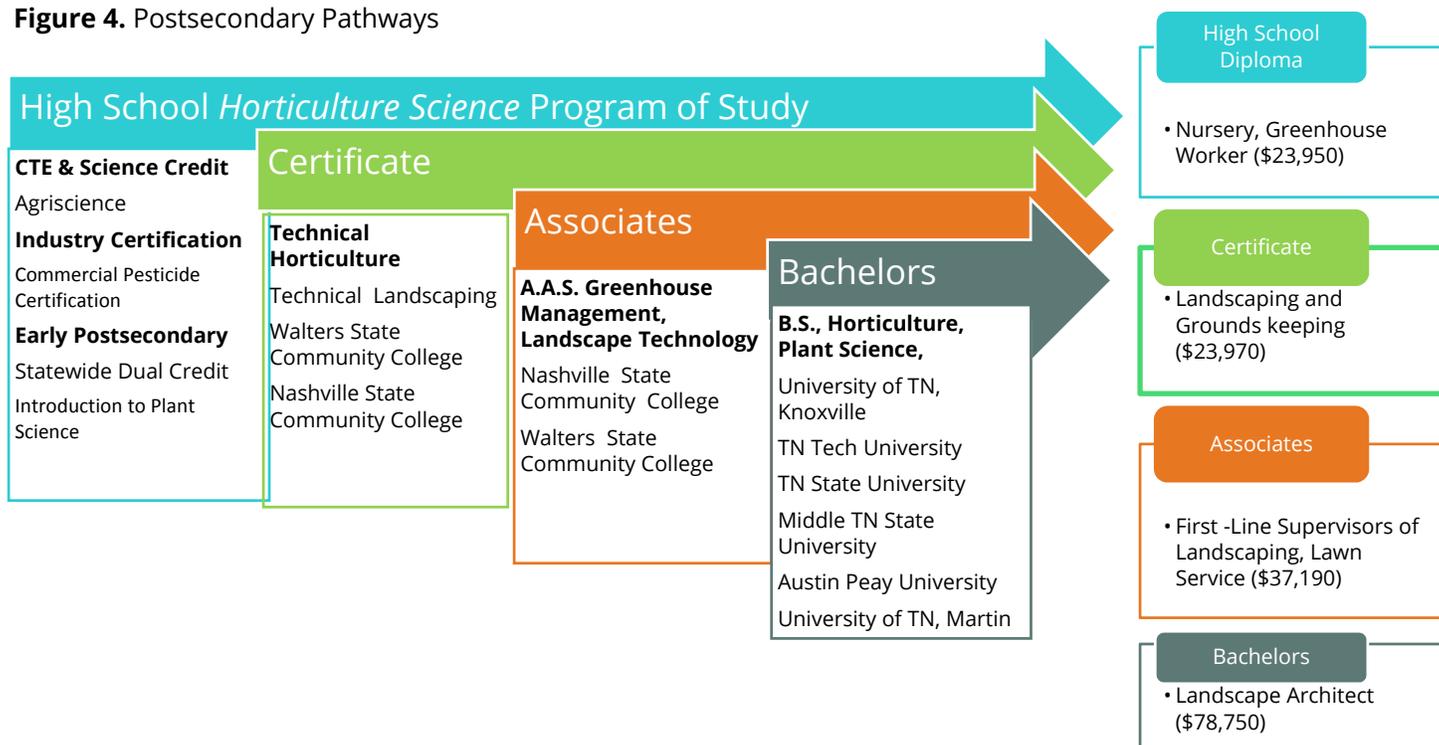
According to a United States Department of Agriculture Employment Opportunities study, nearly 60,000 high-skilled agriculture job openings are expected annually in the U.S. with only 35,000 college graduates available to fill them. The report projects about 50 percent of these jobs will be in the area of business and management related to all agriculture industries with 27 percent of the jobs in science, technology, engineering and mathematics areas.<sup>42</sup> Horticulture Science provides a wide range of career opportunities at the postsecondary level that links to different aspects of the plant science and horticulture areas. Annual median starting wages are based on Bureau of Labor

<sup>42</sup> United States Department of Agriculture. (2015). *Employment Opportunities 2015-2020*. Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015-2020, Eighth. Purdue University. Retrieved March 2016, from <https://www.purdue.edu/usda/employment>

Statistics Occupational Employment Statistics from O\*Net OnLine estimates for Tennessee, unless otherwise indicated:<sup>43</sup>

Upon completion of this program of study, students will be prepared to pursue further study in a variety of horticulture and plant science degrees at the postsecondary level. Specifically, students will be prepared to major in one or more of the following areas: landscape design and construction, turfgrass science and management, public horticulture, organic production, bioenergy, biotechnology or plant science. Typically, a landscape architect and most management positions must have at least a four year degree.<sup>44</sup>

**Figure 4.** Postsecondary Pathways



<sup>43</sup>National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>

<sup>44</sup>National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. O\*NET OnLine. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>.



**Recommendation**

No recommended changes at this time.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Horticulture Science</b>	Agriscience <sup>1</sup> (5957)	Principles of Plant Science and Hydroculture (6119)	Greenhouse Management (5954) -or- <b>Statewide Dual Credit Course</b> Introduction to Plant Science (4269) -or- <b>Dual Enrollment</b> Horticulture Science (4069)	Landscaping and Turf Science (5951) -or- <b>Dual Enrollment</b> Horticulture Science (4069)
				<b>Industry Certification:</b> Commercial Pesticide Certification
	Supervised Agricultural Experience (5964)			

## **References**

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Tennessee Department of Agriculture. (2014). Tennessee Agriculture 2014, Departmental Report and Statistical Summary, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>.

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## Veterinary and Animal Science

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Veterinary and Animal Science</b>	Agriscience (5957)	Small Animal Science (5958)	Large Animal Science (6116)	Veterinary Science (5961)
	Supervised Agricultural Experience (5964)			

### Description

Veterinary and animal science program of study is designed for students interested in learning more about becoming a veterinarian, vet tech, vet assistant, or pursuing a variety of scientific, health, or agriculture professions. The content emphasizes, principles of health and disease, basic animal care and nursing, clinical and laboratory procedures, animal ethics, genetics, and the anatomical/physiological systems of a range of small and large animals. Upon completion of this program of study, students will be prepared for entry level animal science occupations or pursue further study in veterinary and animal science degrees at the postsecondary level. Students passing the capstone certification will be awarded the Tennessee Specific Industry Certification for Animal Science and earn postsecondary credit.

Students can gain job experience while in high school through *supervised agricultural experience (SAE)* program or *work-based learning*. Supervised agricultural experience is a structured experiential learning opportunity for agriculture, food, and natural resources students that takes place in a setting outside of regular school hours. This allows students to experience the diversity of agriculture, food, and natural resources industries and to gain exposure to agricultural-related career pathways.

### Job Outlook

Implementation of the *Governor's Rural Challenge: A 10-Year Strategic Plan* focuses on growth and prosperity of agriculture and forestry industry over the next decade. Education and workforce preparedness were the two major focus areas addressed by the strategic plan. The skillsets for agricultural jobs are more complex and have an increased focus on technology.<sup>45</sup>

Tennessee's robust agricultural production alone, excluding forest products, generates approximately \$2.5 billion annually in farm cash receipts.<sup>46</sup> The agro-forestry industry employed over 363,500 people or 10.3 percent of the

<sup>45</sup> Tennessee Department of Agriculture. (2014). *Tennessee Agriculture 2014, Departmental Report and Statistical Summary*, Retrieved from <http://www.tn.gov/assets/entities/agriculture/attachments/annualreport14.pdf>.

<sup>46</sup> Tennessee Department of Economic and Community Development, Industries, Food & Agribusiness. (2016). HomeGrown. World Famous. Retrieved from <http://www.tnecd.com/industries/food-agribusiness..>

state's total workers.<sup>47</sup> This economic and employment impact provides the justification for the need for skilled workers within the veterinary and animal science program of study to maintain safety and the wholesomeness of animal food products and reducing the public's risk of contracting food borne illnesses.

Colleges of Veterinary Medicine are expected to graduate more students than the demand over the next five years, but not enough will be working with large animals in rural areas.<sup>48</sup> The University of Tennessee study *on Location of Veterinarians and the Economic Impact* of these Veterinary Services to Tennessee's Economy estimated that 24 counties in Tennessee do not have veterinary services for large/mixed animals.<sup>49</sup>

According to the *Employment Opportunities for College Graduates* report from the United States Department of Agriculture, careers in research and development connected with feed and animal-health companies will continue to be strong, especially in poultry, dairy and swine operations<sup>50</sup>, and poultry and swine production managers will be in demand.<sup>51</sup>

There are a wide variety of career opportunities requiring education and training from postsecondary certification to advance degrees. Career One Stop Pathway to Career Success ranked veterinary technologist and technicians as the 39th fastest growing occupations with a 39 percent increase in occupations by 2020. **Figure 1** projects veterinarians to increase 21 percent and nonfarm animal caretakers projected to increase 23 percent in Tennessee.

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<sup>47</sup> Tennessee Department of Agriculture. (2016). *Economic Impacts of Tennessee Agriculture and Forestry*. Retrieved from <http://www.tn.gov/agriculture/article/ag-eac-economic-impact>.

<sup>48</sup>United States Department of Agriculture. (2015). Science & Engineering Trends and Forecast. *Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth*. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/science-and-engineering>.

<sup>49</sup> Menard, J., B. C. English, K. Jensen. "Location of Veterinarians and the Economic Impacts of These Veterinary Services to Tennessee's Economy". Agricultural Experiment Station, University of Tennessee, Knoxville, Tennessee, Jan. 2007. Available at <http://aimag.ag.utk.edu/pubs/ImpactStudyDocument.pdf>

<sup>50</sup> United States Department of Agriculture. (2015). Science & Engineering Trends and Forecast. *Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth*. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/science-and-engineering>

<sup>51</sup> United States Department of Agriculture. (2015). Food & Biomaterials Production Trends and Forecast. *Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015–2020, Eighth*. Purdue University. Retrieved Feb. 2016, from <https://www.purdue.edu/usda/employment/food-and-biomaterials-production>

<sup>52</sup>National Center for O\*NET Development. Agriculture, Food and Natural Resources Career Cluster. *O\*NET OnLine*. Retrieved March 4, 2016, from <http://www.onetonline.org/find/career?c=1&g=Go>

Figure 1.

Tennessee Veterinary Employment Projections for 2020				
Occupation	2012	2020	Change	Annual Job Openings
Veterinarians	1,210	1,470	21%	70
Veterinary technologists and technicians	1,620	2,250	39%	80
Nonfarm animal caretakers	3,160	3,890	23%	110

The larger

population areas of the state provide stronger employment trends for nonfarm animal caretakers as reflected in Figure 2. This trend will continue to increase with population growth.

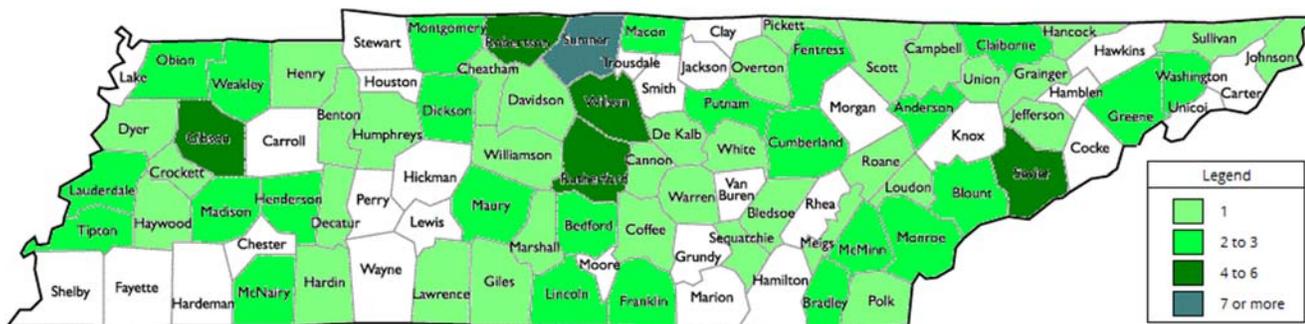
Figure 2.



### Current Secondary Landscape

The veterinary and animal science program of study offerings has increased to 117 programs with a 13 percent increase in student enrollment over the past three years. This program of study has the largest enrollment of all the programs of study with 11,862 or 32 percent of students in the AFNR career cluster for the 2014-15 school year. Open enrollment projections indicate that over 12,000 students based on a three percent increase will be enrolled in one of 120 programs (increase of three), for the 2016-17 school year.<sup>53</sup> Figure 3 shows the distribution of Veterinary and Animal Science programs of study. The high enrollment numbers continue to show career interest in the veterinary and animal sciences field.<sup>54</sup>

Figure 3.



<sup>53</sup> Tennessee Department of Education. (2015). *Student Enrollment Data*. Retrieved from author's calculation of student enrollment data.

<sup>54</sup> Tennessee Department of Education. (2015). *Student Enrollment Data*. Retrieved from author's calculation of student enrollment data.

Dual enrollment and dual credit opportunities with the Veterinary Science course will help to advance the student's progress toward a degree or certificate at the postsecondary level. Development of the Tennessee Specific Industry Certification (TSIC) for Animal Science with aligned postsecondary credit will be a piloted during the 2016-17 school year will strengthen the rigor for this program of study.

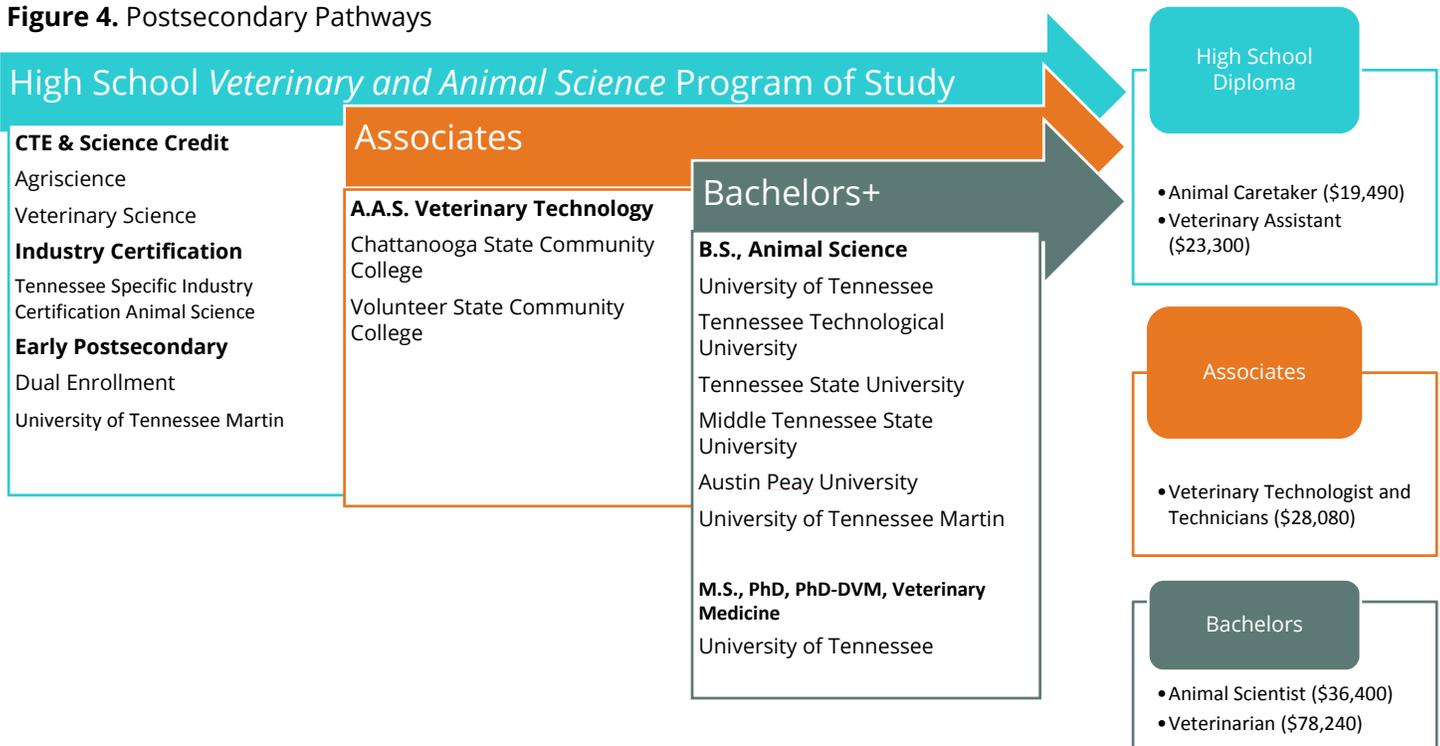
### Postsecondary Pathways

Veterinary and animal science is the program of study linking the foundation of animal science and care to all aspects of our livelihood, food and companion animals. Annual median wages are based on Bureau of Labor Statistics Occupational Employment Statistics (OES) estimates for Tennessee, unless otherwise indicated.

Upon completion of this program of study, students will be prepared to pursue further study in veterinary or a variety of animal sciences degrees at the postsecondary level. Specifically, students will be prepared to major in one or more of the following areas: pre-veterinary medicine, veterinary technician, veterinary assistant, animal production, food science, agricultural business, animal science and biotechnology, and agricultural and extension education. Several related animal industry certifications are available through postsecondary institutions or the University of Tennessee Extension Service.

Veterinary technologists and technicians must complete a postsecondary program in veterinary technology. Typically, both technologists and technicians must take a credentialing exam and must become registered, licensed, or certified. Veterinarians must have a doctorate of veterinary medicine and a state license.

**Figure 4.** Postsecondary Pathways





**Recommendation**

No recommended changes at this time.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Veterinary and Animal Science</b>	Agriscience <sup>1</sup> (5957)	Small Animal Science (5958)	Large Animal Science (6116) -or- <b>Dual Enrollment</b> Veterinary & Animal Science (4065)	Veterinary Science <sup>1</sup> (5961) -or- <b>Dual Enrollment</b> Veterinary & Animal Science (4065)
				<b>Industry Certification:</b> TN Specific Industry Certification Animal Science
	Supervised Agricultural Experience (5964)			



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