

Title 7: Education K-12

Part 71: Mississippi Secondary Curriculum Frameworks in Career and Technical Education, Agriculture, Food & Natural Resources, 2023 Agricultural and Natural Resources



2023 Agricultural and Natural Resources

Program CIP: 01.0003 – Agricultural and Natural Resources

Direct inquiries to:

Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
662.325.2510
helpdesk@rcu.msstate.edu

Program Supervisor
Office of Career and Technical Education
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
601.359.3974

Published by:

Office of Career and Technical Education
Mississippi Department of Education
Jackson, MS 39205

Research and Curriculum Unit
Mississippi State University
Mississippi State, MS 39762

The Research and Curriculum Unit (RCU), located in Starkville, as part of Mississippi State University (MSU), was established to foster educational enhancements and innovations. In keeping with the land-grant mission of MSU, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances the intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

Table of Contents

<u>Acknowledgments</u>	3
<u>Standards</u>	3
<u>Preface</u>	5
<u>Mississippi Teacher Professional Resources</u>	6
<u>Executive Summary</u>	7
<u>Course Outlines</u>	9
<u>Career Pathway Outlook</u>	12
<u>Using This Document</u>	17
<u>Unit 1: Introduction to Agricultural and Natural Resources</u>	17
<u>Unit 2: The National FFA Organization and Career Development</u>	19
<u>Unit 3: Supervised Agricultural Experience (SAE) for All and Embedded Work-Based Learning</u>	21
<u>Unit 4: Science of Animals</u>	23
<u>Unit 5: Science of Plants</u>	25
<u>Unit 6: Soil Science</u>	28
<u>Unit 7: Hand and Power Tools in Agriculture</u>	29
<u>Unit 8: Welding and Cutting Processes</u>	30
<u>Unit 9: Agricultural Small Engines</u>	31
<u>Unit 10: ANR Careers and FFA Leadership</u>	32
<u>Unit 11: Conservation and Management of Natural Resources</u>	33
<u>Unit 12: Science of Forestry and the Environment</u>	35
<u>Unit 13: Wildlife and the Environment</u>	36
<u>Unit 14: Agricultural Equipment Operation and Maintenance</u>	37
<u>Unit 15: Agricultural Construction and Fabrication</u>	38
<u>Unit 16: Agricultural Business Management and Processes</u>	39
<u>Student Competency Profile</u>	39
<u>Appendix: Industry Standards</u>	43

Acknowledgments

The Agricultural and Natural Resources curriculum was presented to the Mississippi State Board of Education on April 19, 2023. The following persons were serving on the state board at the time:

Mr. Michael D. Kent, interim state superintendent of education
Mrs. Rosemary G. Aultman, chair
Mr. Glen V. East, vice-chair
Mrs. Mary Werner
Dr. Ronnie L. McGehee
Dr. Wendi Barrett
Mr. Matt Miller
Mr. Bill Jacobs
Ms. Micah Hill, student representative
Mr. Charlie Fruge', student representative

The following Mississippi Department of Education (MDE) and RCU managers and specialists assisted in the development of the Agricultural and Natural Resources curriculum:

Wendy Clemons, the associate state superintendent of the MDE Office of Secondary, Professional Development, and Career Technical Education, supported the RCU and teachers throughout the development of the framework and supporting materials.
Jill Wagner, the agricultural education and FFA program supervisor of the MDE Office of Career and Technical Education (CTE), supported the RCU and teachers throughout the development of the framework and supporting materials.
Betsey Smith, the director of the RCU, supported RCU staff and teachers throughout the development of this framework and supporting materials.
Courtney McCubbins, the curriculum manager of the RCU, researched and coauthored this framework.
Rob Fyke, a project manager for the RCU, researched and coauthored this framework.

Special thanks are extended to the educators who contributed to the development and revision of this framework and supporting materials:

Patrick Lemoine, Puckett High School, Brandon
Courtney Wilson, Franklin County Career and Technical Center, Meadville
Scott Breedlove, Union High School, Union
Kayla Walters, Forrest County Agricultural High School, Brooklyn
Patricia Braddock, Simpson County Technical Center, Mendenhall
Josh Rusche, McLaurin High School, Florence
Kramer Sowell, Brandon High School, Brandon
Megan White, Stringer Attendance Center, Bay Springs

Standards

Standards and alignment crosswalks are referenced in the appendix. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, English II, and U.S. History from 1877, which could be integrated into the content of the units. Mississippi's CTE Agricultural and Natural Resources is aligned to the following standards:

National Agriculture, Food, and Natural Resources (AFNR) Career Cluster Content Standards

The National AFNR Career Cluster Content Standards were developed by the National Council on Agricultural Education to serve as a guide for what students should know or be able to do through a study of agriculture in Grades 9-12 and two-year postsecondary programs. The standards were extensively researched and reviewed by leaders in the agricultural industry, secondary and postsecondary instructors, and university specialists. The standards consist of a pathway content standard for each of the eight career pathways. For each content standard, performance elements representing major topic areas with accompanying performance indicators were developed. Measurements of assessment of the performance elements and performance indicators were developed at the basic, intermediate, and advanced levels. The National AFNR Career Cluster Content Standards are copyrighted by the National Council for Agricultural Education and used with permission.

thecouncil.ffa.org/afnr

International Society for Technology in Education Standards (ISTE)

Reprinted with permission from *ISTE Standards for Students* (2016). All rights reserved. Permission does not constitute an endorsement by ISTE (iste.org).

College- and Career-Readiness Standards

College- and career-readiness standards emphasize critical thinking, teamwork, and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College- and Career-Readiness Standards (MCCRS) to provide a consistent, clear understanding of what students are expected to learn and so teachers and parents know what they need to do to help them.

mdek12.org/oae/college-and-career-readiness-standards

Framework for 21st Century Learning

In defining 21st-century learning, the Partnership for 21st Century Skills has embraced key themes and skill areas that represent the essential knowledge for the 21st century: global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; environmental literacy; learning and innovation skills; information, media, and technology skills; and life and career skills.

battelleforkids.org/networks/p21/frameworks-resources

Preface

Secondary CTE programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing applied learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments. This document provides information, tools, and solutions that will aid students, teachers, and schools in creating and implementing applied, interactive, and innovative lessons. Through best practices, alignment with national standards and certifications, community partnerships, and a hands-on, student-centered concept, educators will be able to truly engage students in meaningful and collaborative learning opportunities.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Strengthening Career and Technical Education for the 21st Century Act, 2019 [Perkins V]; and Every Student Succeeds Act, 2015).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning

Program resources can be found at the RCU's website, rcu.msstate.edu.

Learning Management System: An Online Resource

Learning management system information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Executive Summary

Pathway Description

Agricultural and Natural Resources (ANR) is a pathway to introduce the student to the broad field of agriculture and natural resources management, including the production of plants and animals and managing the sustainability of our natural resources. The program includes instruction in the applied sciences related to plant and animal production and natural resource conservation and management, as well as introducing the student to agribusiness management practices and maintenance of facilities and equipment. Students in the pathway will participate in active learning exercises, including integral activities of the National FFA organization and supervised agricultural experiences. Students who successfully complete the competencies in this pathway will possess fundamental knowledge and skills that can be used to secure entry-level employment or as a foundation for continuing their education.

College, Career, and Certifications

No national industry-recognized certifications are known to exist at this time in the field of agriculture and natural resources. Competencies and suggested objectives in this course have been correlated, however, to the National AFNR Career Cluster Content Standards that have been reviewed and endorsed at the national level by the National Council on Agricultural Education.

Grade Level and Class Size Recommendations

It is recommended that students enter this program as 10th-12th graders. Exceptions to this are a district-level decision based on class size, enrollment numbers, student maturity, and CTE delivery method. This is a hands-on, lab- or shop-based course. Therefore, a maximum of 15 students is recommended per class with only one class with the teacher at a time.

Student Prerequisites

For students to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
 2. C or higher in high school-level math (last course taken or the instructor can specify the level of math instruction needed)
 3. Instructor approval and Test of Adult Basic Education (TABE) reading score (eighth grade or higher)
- or**
1. TABE reading and math score (eighth grade or higher)
 2. Instructor approval
- or**
1. Instructor approval

Assessment

The latest assessment blueprint for the curriculum can be found at rcu.msstate.edu/curriculum/curriculumdownload.

Applied Academic Credit

The latest academic credit information can be found at
mdek12.org/ese/approved-course-for-the-secondary-schools.

Teacher Licensure

The latest teacher licensure information can be found at
mdek12.org/oel/apply-for-an-educator-license.

Professional Learning

If you have specific questions about the content of any training sessions provided, please contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Course Outlines

Option 1—Four 1-Carnegie Unit Courses

This curriculum consists of four 1-credit courses that should be completed in the following sequence:

1. **Fundamentals of Agricultural and Natural Resources—Course Code: 991102**
2. **Agricultural and Natural Resources: Soils and Ag Lab Operations—Course Code: 991103**
3. **Agricultural and Natural Resources: Environmental Science—Course Code: 991104**
4. **Agricultural and Natural Resources: Equipment Operation and Business MGT—Course Code: 991105**

Course Description: Fundamentals of Agricultural and Natural Resources

This course is designed to introduce the student to fundamental concepts and principles of the modern agricultural and natural resources industry. Emphasis is placed on career and leadership skills and basic principles of plant, animal, and soil science.

Course Description: Agricultural and Natural Resources: Soils and Ag Lab Operations

This course is designed to provide knowledge and skills concerning basic mechanical technologies in the field.

Course Description: Agricultural and Natural Resources: Environmental Science

This course is designed to provide concepts and principles associated with agriculture and natural resources. Emphasis is placed on the conservation and management of natural resources; agricultural business-management practices; and the environment as it relates to water quality, forestry, and wildlife.

Course Description: Agricultural and Natural Resources: Equipment Operation and Business MGT

This course is designed to provide instruction on basic agriculture-construction techniques and agriculture business-management and processes.

Fundamentals of Agricultural and Natural Resources—Course Code: 991102

Unit	Unit Title	Hours
1	Introduction to Agricultural and Natural Resources	15
2	The National FFA Organization and Career Development	15
3	Supervised Agricultural Experience (SAE) for All and Embedded Work-Based Learning	30
4	Science of Animals	40
5	Science of Plants	40
Total		140

Agricultural and Natural Resources: Soils and Ag Lab Operations—Course Code: 991103

Unit	Unit Title	Hours
6	Soil Science	35
7	Hand and Power Tools in Agriculture	35
8	Welding and Cutting Processes	35
9	Agricultural Small Engines	35
Total		140

Agricultural and Natural Resources: Environmental Science—Course Code: 991104

Unit	Unit Title	Hours
10	ANR Careers and FFA Leadership	20
11	Conservation and Management of Natural Resources	40
12	Science of Forestry and the Environment	40
13	Wildlife and the Environment	40
Total		140

Agricultural and Natural Resources: Equipment Operation and Business MGT—Course Code: 991105

Unit	Unit Title	Hours
14	Agricultural Equipment Operation and Maintenance	50
15	Agricultural Construction and Fabrication	50
16	Agricultural Business Management and Processes	40
Total		140

Option 2—Two 2-Carnegie Unit Courses

This curriculum consists of two 2-credit courses that should be completed in the following sequence:

1. **Agricultural and Natural Resources I—Course Code 991100**
2. **Agricultural and Natural Resources II—Course Code 991101**

Course Description: Agricultural and Natural Resources I

This course is designed to introduce the student to fundamental concepts and principles of the modern agricultural and natural resources industry. Emphasis is placed on career and leadership skills; basic principles of plant, animal, and soil science; and basic mechanical technologies in the field.

Course Description: Agricultural and Natural Resources II

This course is designed to continue the exploration of fundamental concepts and principles associated with agriculture and natural resources. Emphasis is placed on the conservation and management of natural resources; agricultural business-management practices; and the environment as it relates to water quality, forestry, and wildlife. Instruction is provided on basic agriculture-construction techniques and agriculture business management and processes.

Agricultural and Natural Resources I—Course Code: 991100

Unit	Unit Title	Hours
1	Introduction to Agricultural and Natural Resources	15
2	The National FFA Organization and Career Development	15
3	Supervised Agricultural Experience (SAE) for All and Embedded Work-Based Learning	30
4	Science of Animals	40
5	Science of Plants	40
6	Soil Science	35
7	Hand and Power Tools in Agriculture	35
8	Welding and Cutting Processes	35
9	Agricultural Small Engines	35
Total		280

Agricultural and Natural Resources II—Course Code: 991101

Unit	Unit Title	Hours
10	ANR Careers and FFA Leadership	20
11	Conservation and Management of Natural Resources	40
12	Science of Forestry and the Environment	40
13	Wildlife and the Environment	40
14	Agricultural Equipment Operation and Maintenance	50
15	Agricultural Construction and Fabrication	50
16	Agricultural Business Management and Processes	40
Total		280

Career Pathway Outlook

Overview

The agricultural sciences career cluster covers the broad field of occupations related to the production and use of plants and animals for food, fiber, aesthetic, and environmental purposes. According to the U.S. Department of Agriculture, during the next five years (2020-2025) 59,400 jobs are expected to open in food, agriculture, renewable natural resources, or the environment for graduates with bachelor's or higher degrees in those areas. Almost half of those jobs will be in management and business at 42%; 31% in science, technology, engineering, and math in agriculture; 13% in sustainable food and biomaterials production; and 14% in education, communication, and government services. According to the USDA, agriculture, food, and related industries contributed \$1.109 trillion to the U.S. gross domestic product (GDP) in 2019. The Mississippi Department of Agriculture and Commerce reports that agriculture is Mississippi's number one industry at \$7.35 billion and employs approximately 17.4% of the state's workforce.

Exploration of Agriscience will target careers at the professional and technical levels in agriculture. Students enrolled in these courses should be better prepared to pursue degrees at the community college and four-year college levels.

Needs of the Future Workforce

Data for this synopsis were compiled from the Mississippi Department of Employment Security (2022). Employment opportunities for each of the occupations are listed below:

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2018	Projected Jobs, 2028	Change (Number)	Change (Percent)	Average Yearly Earnings, 2022
Agricultural and Food Science Technicians	260	270	10	3.9%	\$39,270
Agricultural Sciences Teachers, Postsecondary	150	160	10	6.7%	\$93,260
Animal Trainers	100	110	10	10%	\$23,120
Career/Technical Education Teachers, Middle School	320	350	30	9.4%	\$47,270
Career/Technical Education Teachers, Secondary School	1220	1310	90	7.4%	\$50,370
Conservation Scientists	700	730	30	4.3%	\$54,950
Environmental Engineers	410	420	10	2.4%	\$75,940
Environmental Engineering Technicians	160	170	10	6.3%	\$46,790
Environmental Scientists and Specialists, Including Health	620	670	50	8.1%	\$64,460

Environmental Science and Protection Technicians, Including Health	420	460	40	9.5%	\$38,780
Farm and Home Management Advisors	290	300	10	3.2%	\$38,650
Logging Equipment Operators	1,680	1,740	60	3.6%	\$41,840
Landscaping and Groundskeeping Workers	6,000	6,620	620	10.3%	\$25,630
Nonfarm Animal Caretakers	1,520	1,780	260	17.1%	\$24,030
Soil and Plant Scientists	110	110	0	0%	\$92,250
Farmers, Ranchers, and Other Agricultural Managers	1,790	1,840	20	2.8%	\$55,830
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	980	1,090	110	11.2%	\$40,270
First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers	940	990	50	5.3%	\$54,550
Fish and Game Wardens	40	40	0	0%	\$46,610
Foresters	190	200	10	5.3%	\$52,660
Surveyors	450	470	20	4.4%	\$48,600
Surveying and Mapping Technicians	530	550	20	3.8%	\$39,840
Tree Trimmers and Pruners	270	300	30	11.1%	\$44,920
Veterinarians	490	540	50	10.2%	\$81,950
Veterinary Assistants and Laboratory Animal Caretakers	970	1,090	120	12.4%	\$26,150
Veterinary Technologists and Technicians	570	630	60	10.5%	\$35,890
Zoologists and Wildlife Biologists	260	270	10	3.9%	\$70,200

Source: Mississippi Department of Employment Security; mdes.ms.gov (2022).

Perkins V Requirements and Academic Infusion

The Agricultural and Natural Resources curriculum meets Perkins V requirements of introducing

students to and preparing them for high-skill, high-wage occupations in agricultural science fields. It also offers students a program of study, including secondary, postsecondary, and institutions of higher learning courses that will further prepare them for agricultural industry careers. Additionally, this curriculum is integrated with academic college- and career-readiness standards. Lastly, it focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Transition to Postsecondary Education

The latest articulation information for secondary to postsecondary can be found at the Mississippi Community College Board website, mccb.edu.

Best Practices

Innovative Instructional Technologies

Classrooms should be equipped with tools that will teach today's digital learners through applicable and modern practices. The ANR educator's goal should be to include teaching strategies that incorporate current technology. To make use of the latest online communication tools—wikis, blogs, podcasts, and social media platforms, for example—the classroom teacher is encouraged to use a learning management system that introduces students to education in an online environment and places more of the responsibility of learning on the student.

Differentiated Instruction

Students learn in a variety of ways, and numerous factors—students' background, emotional health, and circumstances, for example—create unique learners. By providing various teaching and assessment strategies, students with various learning preferences can have more opportunities to succeed.

CTE Student Organizations

Teachers should investigate opportunities to sponsor a student organization. The National FFA Organization is the student organization for this pathway and will foster the types of learning expected from the ANR curriculum. FFA provides students with growth opportunities and competitive events and opens the doors to the world of agriculture and scholarship opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the ANR curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The ANR curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the ANR curriculum that will allow and encourage collaboration with professionals currently in the agricultural field.

Work-Based Learning

Work-based learning (WBL) is an extension of understanding competencies taught in the ANR classroom. The ANR program requires students to obtain a minimum of 35 hours, which may include but are not limited to clinicals or worksite field experiences, entrepreneurship, internships, pre-apprenticeships, school-based enterprises, job placements, and simulated worksites. These real-world connections and applications provide a link to all types of students regarding knowledge, skills, and professional dispositions. Thus, supervised collaboration and immersion into the agricultural industry are keys to students' success, knowledge, and skills development. For more information on embedded WBL, visit the Mississippi Work-Based Learning Manual on the RCU website, rcu.msstate.edu.

Professional Organizations

American Association for Agricultural Education (AAAE)

aaaeonline.org

Association for Career and Technical Education (ACTE)

acteonline.org

Mississippi Association of Agricultural Educators (MSAAE)

mississippiffa.org

Mississippi ACTE (MS ACTE)

mississippiaccte.com

National Association of Agricultural Educators (NAAE)

naae.org

National FFA Organization

ffa.org

Using This Document

Competencies and Suggested Objectives

A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

Teacher Resources

All teachers should request to be added to the Canvas Resource Guide for their course. For questions or to be added to the guide, send a Help Desk ticket to the RCU by emailing helpdesk@rcu.msstate.edu.

Perkins V Quality Indicators and Enrichment Material

Some of the units may include an enrichment section at the end. This material will greatly enhance the learning experiences of students. If the ANR program is using a national certification, work-based learning, or another measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be tested on that quality indicator. It is the responsibility of the teacher to ensure all competencies for the selected quality indicator are covered throughout the year.

Unit 1: Introduction to Agricultural and Natural Resources

Competencies and Suggested Objectives
1. Examine the nature of the Agricultural and Natural Resources (ANR) industry. ^{DOK1} a. Investigate the scope of the ANR industry from a national and global perspective. b. Trace the development of agricultural sciences and technologies in the United States. c. Associate the major areas of ANR with their products and practices. d. Investigate career opportunities in ANR.
2. Examine the relationships between the pure sciences, agriculture, and agriscience. ^{DOK1} a. Associate the pure sciences with agriculture and agriscience areas. b. Identify a problem in agriculture and follow the steps of the scientific method to investigate a possible solution to the problem.
3. Apply standard ANR safety practices. ^{DOK2} a. Apply safety standards in the workplace. b. Apply safety standards in the agricultural classroom and laboratory. c. Interpret information on a safety data sheet (SDS). d. Describe the use of general-safety hand equipment and indicators including, but not limited to, the following: safety color codes, fire extinguishers, first aid kits, emergency exits, etc. e. Apply safety precautions related to dress and personal protective equipment (PPE). f. Select procedures for dealing with different classes of fires.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 2: The National FFA Organization and Career Development

Competencies and Suggested Objectives

1. Explore the integral relationship between the FFA and agricultural education. ^{DOK 2}
 - a. Examine historical events that shaped school-based agricultural education.
 - Smith-Hughes Act (1917)
 - Establishment of the Future Farmers of America (FFA) (1928)
 - Mississippi FFA Association chartered (1934)
 - Establishment of New Farmers of America (NFA) (1935)
 - Public Law 740 (1950)
 - Merger of the FFA and NFA (1965)
 - Female membership (1969)
 - FFA changes its name to the National FFA Organization (1988)
 - b. Identify types of FFA membership.
 - Active
 - Collegiate
 - Alumni
 - Honorary
 - c. Distinguish among the degree levels of FFA membership and describe the requirements for each:
 - Discovery FFA degree
 - Greenhand FFA degree
 - Chapter FFA degree
 - State FFA degree
 - American FFA degree
2. Explore the role of the FFA in promoting leadership, personal growth, and career success through 21st century skills standards. ^{DOK2}
 - a. Explain the role of effective leadership.
 - b. Self-evaluate personal leadership traits and develop a plan for improvement.
 - c. Identify and put into practice FFA activities that promote personal and career development, teamwork, and leadership skills.
 - Public speaking and communication skills
 - Career development events (CDEs) and leadership development events (LDEs)
 - Proficiency awards
 - Community service activities
 - Conventions and leadership conferences
 - d. Demonstrate basic parliamentary procedure.
 - Conducting a meeting
 - Stating a main motion
 - Discussing the main motion
 - Voting on a motion
 - Understanding the use of the gavel
 - e. Distinguish between types of motions:
 - Main

• Subsidiary • Incidental • Privileged
3. Describe the role of 21st-century skills, work ethic, and values in establishing and building a successful career. ^{DOK3} - Define and describe universally accepted work ethics and values as applied to agricultural, food, and natural resources careers. • Trustworthiness • Respect • Responsibility • Fairness • Citizenship - Identify career-related values and ethics promoted through FFA activities. • Attendance • Attitude • Achievement • Relationship building • Vision • Character • Awareness • Continuous improvement • Personal growth • Time management • Communication • Decision-making • Flexibility and adaptability - Practice work ethic and values in the ANR classroom and laboratory, student organization activities, and experiential and work-based learning.
4. Investigate careers associated with the agricultural industry and complete a project with details about a career. ^{DOK2} - Description of the career - Educational and training requirements - Salary range - Job outlook

Unit 3: Supervised Agricultural Experience (SAE) for All and Embedded Work-Based Learning

Competencies and Suggested Objectives

1. Describe the purposes and requirements of the Supervised Agricultural Experience (SAE) for All program. ^{DOK1}
 - a. Establish objectives for the SAE program.
 - Personal growth
 - Career development
 - Responsible citizenship
 - Practical application of work experience and/or skill attainment
 - b. Determine the benefits of participation in an SAE program.
 - Assist with career and personal choices
 - Apply business practices, such as record-keeping and money management
 - Nurture individual talents and develop a cooperative attitude
 - Build character and encourage citizenship and volunteerism
 - Provide an environment for practical learning
 - c. Describe the types of programs under SAE For All.
 - Foundational SAE
 - Career exploration and planning
 - Employability skills for college and career readiness
 - Personal financial management and planning
 - Workplace safety
 - Agricultural literacy
 - Immersion SAE
 - Placement/internship
 - Ownership/entrepreneurship
 - Research
 - Experimental
 - Analytical
 - Invention
 - School-based enterprise
 - Service learning
 - d. Explore the Mississippi Work-Based Learning (WBL) Manual as a companion to Immersion SAE.
2. Launch a Foundational SAE plan. ^{DOK2}
 - a. Identify potential career interests.
 - b. Determine the availability of time and money/resources to invest.
 - c. Set short-range goals for the SAE program.
 - d. Project long-range goals for the SAE program.
 - e. Complete a training agreement for an SAE project.
 - f. Establish requirements for the student, parents, supervisor, and/or employer.

3. Develop a record-keeping system for an individual student's SAE program.^{DOK3}
- a. Determine types of records to keep.
 - Hours worked/spent on a project or enterprise
 - Inventory of assets
 - Expenses
 - Income
 - Skills attained during a project or enterprise
 - Leadership record
 - Community service record
 - Journal of experiences
 - Pictures and/or videos
 - b. Use an electronic/computer-based record-keeping system to maintain records for the SAE program.

Unit 4: Science of Animals

Competencies and Suggested Objectives

1. Explore the animal-agriculture industry and enterprises. ^{DOK1}
 - a. Associate the different classes and breeds of domestic animals with ways that each benefits humanity.
 - Aquatic animals
 - Beef and dairy cattle
 - Equine
 - Swine
 - Poultry
 - Goats and sheep
 - Companion animals
 - b. Compare and contrast common production and marketing practices for major animal enterprises.
 - c. Distinguish between small-scale (niche markets) versus commercial production.
 - d. Compare and contrast the concepts of animal rights and animal welfare as related to agricultural-animal enterprises.
2. Compare and contrast animal systems for mammals, avian, and aquatic animals including, but not limited to, respiratory, skeletal, and circulatory. ^{DOK1}
3. Examine the role of reproduction and genetics in agricultural animals. ^{DOK2}
 - a. Explain procedures for managing livestock production.
 - b. Define terms associated with livestock production.
 - c. Describe periods of estrus and gestation in livestock.
 - d. Describe the process of livestock mating.
 - Inbreeding
 - Closed breeding
 - Crossbreeding
 - Linebreeding
 - Outcrossing
 - e. Explain basic concepts of heredity and genetics.
 - Punnett squares
 - Homozygous
 - Heterozygous
 - Recessive
 - Dominant
 - Hybrid vigor
 - Heterosis
 - Estimated Progeny Difference (EPD)
 - f. Explore technologies in livestock reproduction.
 - Artificial insemination
 - Embryo transfer
 - Cloning
 - Gender selection

• Genetic engineering
4. Describe important elements of animal nutrition and digestion. ^{DOK2} - Compare and contrast the following digestive systems: • Ruminant • Monogastric • Avian • Pseudo-ruminant (hind gut fermenter) - Associate each of the six major classes of nutrients with their roles and functions. • Water • Carbohydrates • Protein • Fats • Vitamins • Minerals - Classify and discuss the use of feedstuffs as roughages, concentrates, processed feeds, and by-products. • Roughage examples: hay, cottonseed hulls, and silage • Concentrate examples: corn, soybeans, and oats • Processed feed examples: pelleted feed • By-product examples: soybean meal, cotton-seed meal, distillers' grains
5. Explain management practices for maintaining health in beef, dairy, swine, poultry, equine, aquaculture, and other species of local interest. ^{DOK2} - Examine management practices for maintaining animal health. - Examine causes and preventions of disease and parasites. - Investigate the economic impact of sound herd health management practices. - Investigate biosecurity practices related to animal health.

Unit 5: Science of Plants

Competencies and Suggested Objectives

1. Examine basic plant classifications. ^{DOK2}
 - a. Identify and discuss vascular and nonvascular plants.
 - b. Identify and discuss vascular plants that reproduce with the help of seeds and those that reproduce with the help of spores (seedless).
 - c. Compare and contrast the two groups of vascular seed producing plants.
 - Angiosperms
 - Gymnosperms
 - d. Investigate the life cycles of angiosperm plants.
 - Annual
 - Perennial
 - Biennial
 - e. Examine the binomial nomenclature system used by scientists around the world to give plants scientific names.
 - f. Demonstrate how scientists name plants using the genus and species.
 - g. Research common names of plants and determine the scientific name (i.e., Loblolly Pine Tree = *Pinus taeda*)
 - h. Identify and describe plants that are categorized as cereal crops, oil crops, forage crops, fiber crops, horticultural crops, and specialty crops.
2. Explore the anatomy and physiology of a plant. ^{DOK1}
 - a. Draw a diagram of a flowering plant, label, and describe the functions of the major parts.
 - Roots
 - Stems
 - Leaves
 - Flowers
 - b. Compare and contrast the processes of photosynthesis and cell respiration within a plant.
 - c. Illustrate and label the process of plant transpiration. Show how water flows through the following plant parts within the illustration:
 - Roots (osmosis)
 - Stem (xylem)
 - Leaves (stomata)
 - d. Examine the process of plant growth to include cell division, cell elongation, and cell differentiation.

3. Investigate common methods of plant reproduction. ^{DOK2} a. Investigate methods of pollination and fertilization within angiosperms (flowering plants). b. Draw and label a simple flower. Include the following parts: • Stamen: anther and filament • Pistil: stigma, style, ovary, ovule c. Investigate methods of pollination and fertilization within gymnosperms (non-flowering plants). d. Identify the parts of a seed and associate each part with its function. • Seed coat • Stored food (endosperm/cotyledon) • Embryo (epicotyl) e. Identify and discuss seed dispersal methods. • Wind (dandelion seeds) • Water (mangrove seeds) • Animals (seeds in fruits and burdock seeds) • Fire (eucalypts seeds and some seeds in conifer trees) • Explosions (pea seeds in a pod) f. Describe and apply factors essential to seed germination. • Light or lack of light (photoperiod) • Temperature • Moisture • Viable seed • Oxygen g. Identify the five methods of asexual propagation. • Layering • Budding/grafting • Separation/division • Tissue culture • Cuttings														
4. Apply principles of plant nutrition. ^{DOK4} a. Differentiate between the major plant nutrients (macronutrients) and the minor nutrients (micronutrients). b. Classify and explain the function of each of the nonmineral nutrients, primary and secondary macronutrients, and micronutrients in plant growth. <table> <tr> <th>Nonmineral Nutrients</th><th>Primary Macronutrients</th><th>Micronutrients</th></tr> <tr> <td> • Carbon (C) • Hydrogen (H) • Oxygen (O) </td><td> • Nitrogen (N) • Phosphorus (P) • Potassium (K) </td><td> • Boron (B) • Chlorine (Cl) • Copper (Cu) • Iron (Fe) • Manganese (Mn) • Molybdenum (Mo) • Nickel (Ni) </td></tr> <tr> <th>Secondary Macronutrients</th><td></td><td></td></tr> <tr> <td> • Calcium (CA) • Magnesium (Mg) </td><td></td><td></td></tr> </table>			Nonmineral Nutrients	Primary Macronutrients	Micronutrients	• Carbon (C) • Hydrogen (H) • Oxygen (O)	• Nitrogen (N) • Phosphorus (P) • Potassium (K)	• Boron (B) • Chlorine (Cl) • Copper (Cu) • Iron (Fe) • Manganese (Mn) • Molybdenum (Mo) • Nickel (Ni)	Secondary Macronutrients			• Calcium (CA) • Magnesium (Mg)		
Nonmineral Nutrients	Primary Macronutrients	Micronutrients												
• Carbon (C) • Hydrogen (H) • Oxygen (O)	• Nitrogen (N) • Phosphorus (P) • Potassium (K)	• Boron (B) • Chlorine (Cl) • Copper (Cu) • Iron (Fe) • Manganese (Mn) • Molybdenum (Mo) • Nickel (Ni)												
Secondary Macronutrients														
• Calcium (CA) • Magnesium (Mg)														

• Sulfur (S)	• Zinc (Zn)
5.	
5. Compare and contrast the different components of integrated pest management (IPM) measures. ^{DOK3}	
a. Research the effects of each IPM component.	
• Chemical • Mechanical • Biological • Cultural	

Unit 6: Soil Science

Competencies and Suggested Objectives
1. Demonstrate an understanding of the impact of soil as a natural resource. ^{DOK1} a. Define soil and discuss its importance. b. Describe the process of soil formation, including the effects of chemical and physical weathering. c. Classify and determine the texture of a soil sample utilizing the United States Department of Agriculture (USDA) soil texture triangle. • Sand • Silt • Clay d. Identify the different layers of a typical soil profile and describe their importance. • O — organic • A — topsoil • B — subsoil • C — parent material • R — bedrock
2. Investigate the chemical properties of soils. ^{DOK3} a. Develop a written soil-testing plan for a given field or area. b. Collect a soil sample for testing purposes. c. Define soil pH. d. Describe how soil pH affects the productivity of a soil. e. Test a soil for pH level and nutritional content and make recommendations on amendments and fertilizers to be applied.

Unit 7: Hand and Power Tools in Agriculture

Competencies and Suggested Objectives
1. Identify and demonstrate the proper use of hand and power tools. ^{DOK1} a. Identify hand and power tools listed in the Mississippi Tool Identification contest and the National FFA Agricultural Technology and Mechanical Systems CDE. b. Demonstrate safety procedures when dealing with hand and power tools, including basic operation, danger point, observer safety, and electrical safety. c. Demonstrate the use of tools specific to the local program.
Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 8: Welding and Cutting Processes

Competencies and Suggested Objectives

1. Identify common equipment, tools, and safety procedures, and perform the various welding processes. ^{DOK1}
 - a. Identify major types of welders.
 - Shield metal arc welding (SMAW)
 - Gas metal arc welding (GMAW)
 - Gas tungsten arc welding (GTAW)
 - b. Describe and identify different supplies used in welding.
 - Electrodes
 - Low-hydrogen, mild steel, and alloy welding
 - Gases in the GMAW process
 - Argon
 - CO₂
 - Mixed gas (argon/CO₂)
 - c. Perform welding techniques utilizing the appropriate welding process.
 - Start, stop, and restart
 - Pad construction
 - Flat-butt construction
 - Beads, fillet (T), lap, corner, and edge (SMAW, GMAW)
2. Apply safety procedures and perform tasks using oxyacetylene equipment (OAW). ^{DOK2}
 - a. Identify and demonstrate parts of the oxyacetylene cutting equipment utilizing all safety protocols.
 - b. Identify the different types of oxyacetylene flames and the applications of each, including neutral, oxidizing, and carburizing.
 - c. Assemble and operate oxyacetylene cutting equipment. Set up equipment for cutting operations, to include selecting the proper tip and setting regulator pressures.
 - d. Discuss oxyacetylene welding (brazing).

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 9: Agricultural Small Engines

Competencies and Suggested Objectives

1. Apply safety procedures and examine the major parts and function of a small engine. ^{DOK1}
 - a. Identify and demonstrate the use of specific hand tools and diagnostic instruments used in small-engine maintenance and repair.
 - b. Identify and discuss the fundamentals of the combustion engine, including the difference between two- and four-cycle engines.
 - Air intake and exhaust
 - Fuel
 - Compression
 - Ignition
 - c. Identify the common systems of a small gasoline engine.
 - Ignition
 - Air intake
 - Lubrication
 - Power train
 - Cooling
 - Exhaust
 - Fuel systems
 - d. Determine which basic tools are essential for engine repair.
 - One set of each socket, open-end, and box wrenches $\frac{1}{4}$ in. to 1 in.
 - Hex wrench set
 - 6-in. and 10-in. adjustable wrenches
 - Torque wrench
 - Slip-joint pliers
 - Long-nose pliers
 - Ball peen hammer
 - Chisels
 - Punches
 - Standard and Phillips-head screwdrivers

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 10: ANR Careers and FFA Leadership

Competencies and Suggested Objectives	
1. Review safety rules and behavior. ^{DOK1}	
a. Identify safety rules and behavior for the classroom.	
b. Identify safety rules and behavior for the shop and laboratory areas.	
2. Investigate and develop skills necessary for pursuing a career in ANR. ^{DOK2}	
a. Discover the careers available in ANR.	
b. Build a personal résumé and cover letter for the purpose of applying for jobs.	
c. Perform a mock interview utilizing the personal résumé and cover letter.	
3. Develop an individual FFA activity plan. ^{DOK2}	
a. Identify and participate in FFA activities and programs that contribute to career advancement and individual achievement.	
b. Select and document FFA activities and programs that contribute to personal development.	
4. Develop and present a 3 to 5-minute presentation on an ANR topic. ^{DOK2}	
a. Discuss guidelines for preparing a successful presentation, including preparation, resource development, writing skills, and presentation skills.	
5. Develop an Immersion SAE and maintain records in an electronic record-keeping system. ^{DOK3}	

Unit 11: Conservation and Management of Natural Resources

Competencies and Suggested Objectives

1. Explore basic concepts of natural resources and conservation management. ^{DOK1}
 - a. Describe the nature and importance of sustainable agriculture.
 - Renewable resources
 - Nonrenewable resources
 - b. Explore the services of agencies and organizations that protect and maintain the environment.
 - Natural Resources Conservation Service (NRCS)
 - United States Department of Agriculture (USDA)
 - Bureau of Land Management (BLM)
 - Farm Service Agency (FSA)
 - c. Identify and select practices that promote sustainability in agriculture.
 - No-till
 - Grass waterways
 - Strip tilling
 - Terraces
 - Cover crops
 - Rotational grazing
2. Explore the principles and applications of precision-farming operations. ^{DOK2}
 - a. Discover how Geographic Information System (GIS) mapping and Global Positioning System (GPS) technology are creating a shift from traditional agricultural practices.
 - b. Recognize and discuss how GIS maps can assist a farmer with various tasks.
 - Crop management
 - Site suitability
 - Drainage planning
 - Flood prevention/management
 - Drought prevention/management
 - Erosion prevention/management
 - Disease control
 - c. Discuss ways that GPS technology is used in precision-farming operations.
 - Farm planning
 - Field mapping
 - Soil sampling
 - Tractor guidance
 - Crop scouting
 - Variable rate applications
 - Yield mapping
 - Working during low-visibility field conditions
 - d. Compare and contrast variable-rate versus site-specific application of fertilizers and

chemicals.
3. Explore air and water quality. ^{DOK2} - Discuss the sources of water and potential threats to each source. - Water cycle - Water uses - Water pollution - Discuss the sources of air pollution and precautions that can be taken to reduce or prevent pollution. - Equipment - Pesticides - Agricultural waste - Dust, smoke, and odors
4. Investigate the use of the land-capability classification system. ^{DOK1} - Describe the concepts of land-capability classification (I-VIII). - Identify and describe factors that contribute to land capability. - Slope - Texture - Runoff - Permeability - Erosion - Contrast types of soil erosion and controls. - Identify the different types of soil erosion. - Identify different practices that can be used to control erosion. - Apply erosion control practices to different agricultural scenarios. - Evaluate a given location for home site suitability. - Identify factors that should be evaluated in selecting a home site. - Classify a given location using home site selection criteria.

Enrichment
1. Refer to the Land Judging in Oklahoma manual published by Oklahoma State University Extension as a guide to the Land Evaluation CDE. https://landjudging.com

Unit 12: Science of Forestry and the Environment

Competencies and Suggested Objectives

1. Examine basic principles of forest dendrology and mensuration. ^{DOK2}
 - a. Examine the layered structure of forests and how these layers protect and enhance the ecosystem.
 - Emergent
 - Canopy
 - Understory/shrub layer
 - Forest floor
 - b. Identify locally important trees by type, physical characteristics, and use.
 - Softwoods (e.g., loblolly pine, long leaf pine, cedars, etc.)
 - Hardwoods (e.g., oak, sweet gum, hickory, etc.)
 - c. Analyze the growth rate and age of trees by examining the annual rings and accounting for variations in growth rate due to environmental factors.
2. Discuss the relationship of forestry to environmental quality and economic development. ^{DOK2}
 - a. Identify consumer goods derived from forestry.
 - Paper products
 - Lumber and building products
 - Finished products (i.e., consumer goods)
 - b. Define biodiversity and describe its relationship to forestry.
 - c. Investigate methods for forest fire prevention.
 - Control burns
 - Fire lanes
 - Fire prevention marketing and education
 - d. Discuss the different damages caused by forest fires.
 - Loss of habitat
 - Environmental degradation
 - Loss of revenue
 - Property damage and loss
 - e. Discuss the methods of reforestation.
 - Natural reseeding
 - Hand or machine planting

Unit 13: Wildlife and the Environment

Competencies and Suggested Objectives
1. Examine the relationships of wildlife well-being and environmental quality. ^{DOK1} - Identify common wildlife species found in Mississippi, and classify each as terrestrial or aquatic (e.g., whitetail deer, raccoons, turkeys, opossums, turtles, bass, crappie, wild hogs, etc.). - Describe the importance of wildlife to the environment and human well-being. - Recommend procedures for improving wildlife habitats. - Constructing food plots - Following responsible hunting practices - Observing environmental regulations
2. Explore concepts and practices related to wildlife conservation and management. ^{DOK1} - Create a diagram illustrating the interrelationships among the soil, plants, animals, and humans (i.e., a food web). - Discuss the concept of a food web.
3. Investigate approaches to protecting and managing wildlife species. ^{DOK2} - Discuss the need for wildlife protection and conservation policies and how species are lost from the earth. - Classify wildlife species based on threats to their continued existence. - Endangered - Threatened - Extinct - Describe practices in conservation, protection, and management of wildlife. - Game laws and limits - Sustainability of the ecosystem - Establishment of wildlife refuges - Natural versus artificial population management

Unit 14: Agricultural Equipment Operation and Maintenance

Competencies and Suggested Objectives
1. Inspect, maintain, and repair agricultural equipment. ^{DOK4} a. Describe procedures for completing an inspection of agricultural equipment. • Coolant • Engine oil • Tire pressure • Hydraulic fluid • Gear oil • Air filters b. Perform operation and maintenance checks on agricultural equipment according to manufacturer's specifications. c. Assess parts to repair or replace based on manufacturer's specifications and observations. d. Perform maintenance for required parts, reassemble, adjust, and test.
2. Perform reconditioning of agricultural machinery and equipment. ^{DOK4} a. Recondition agricultural machinery and equipment based on local availability. b. Select and demonstrate proper equipment for a specific job and develop a bill of materials for that job. c. Estimate materials for a specific task.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 15: Agricultural Construction and Fabrication

Competencies and Suggested Objectives	
1. Select and demonstrate proper equipment for a specific construction job. ^{DOK2}	- Identify tools and equipment for a specific job. - Select and use hand and power tools safely and properly. - Demonstrate mathematical concepts in measurement.
2. Develop a bill of materials for a specific job. ^{DOK2}	- Compare dimensions, kind, and amounts of materials needed. - Explain the use of wood, metal, fasteners, wire, concrete, and roofing materials. - Design and build a structure. - Foundation - Wall construction - Roof construction
3. Identify and demonstrate electrical procedures and proper use of hand and power tools. ^{DOK2}	- Apply rules for hand and power tools, including basic operation, danger point, observer safety, and electrical safety. - Explain the relationship between volts, amps, and watts. - Demonstrate use of a voltmeter, amp meter, pliers, screwdrivers, wire cutters, and wire strippers in electrical work. - Discuss the causes of electrical accidents, including short circuits, overloads, improper insulation, and the presence of moisture. - Demonstrate procedures for preventing electrical accidents. - Proper tool maintenance - Disconnecting of power when working on circuits (lockout-tag out) - Proper operation of breakers, fuses, ground fault circuit interrupters (GFCI), grounding, and other appropriate safety devices
4. Perform welds with SMAW equipment. ^{DOK4}	- Fabricate a single v-groove butt weld in the horizontal position. - Fabricate a single v-groove butt weld in the vertical up position.
5. Perform welds with GMAW equipment. ^{DOK4}	- Fabricate a single v-groove butt weld in the horizontal position. - Fabricate a single v-groove butt weld in the vertical up position.
6. Cut metal with a plasma arc cutter. ^{DOK4}	- Identify safety rules and practices associated with a plasma arc cutter. - Perform safe and proper operation of a plasma arc cutter.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 16: Agricultural Business Management and Processes

Competencies and Suggested Objectives	
1. Explore banking services for personal and business accounts. ^{DOK2}	- Identify common types of personal savings and checking options. - Create and maintain a transaction register. - Demonstrate how to write a check. - Demonstrate how to write a deposit slip. - Reconcile a bank statement. - Investigate online banking services, including online security, identity theft, and fraud-prevention procedures.
2. Explore concepts of credit. ^{DOK2}	- Identify and compare sources of credit (e.g., credit card, bank, finance company, credit union, government agency, etc.) - Describe factors that indicate a good credit rating (e.g., returns, repayment capacity, risk, etc.) - Discuss guidelines for wise use of credit. - Describe procedures for obtaining credit. - Explain how credit is used in the decision-making process.
3. Compare loan options. ^{DOK2}	- Discuss the different uses of loan funds (e.g., business and personal loans). - Describe procedures for obtaining agribusiness loans. - Identify types of collateral that can be used to obtain a loan. - Calculate the cost of a loan. - Explain the process of filling out a loan application.
4. Explore basic principles of agricultural economics and marketing. ^{DOK2}	- Compare and contrast the types of business organizations. - Individual - Partnership - Cooperative - Corporation - Describe the law of supply and demand. - Differentiate between wholesale and retail marketing.
5. Discuss the principles and practices of an agricultural business. ^{DOK2}	- Discuss taxes and insurance as related to agricultural businesses. - Liability, life, medical, and property insurance - Personal income, property taxes, W-2, 1099, and 1040EZ forms - Develop a business plan.

Student Competency Profile

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Introduction to Agricultural and Natural Resources		
	1.	Examine the nature of the Agricultural and Natural Resources (ANR) industry.
	2.	Examine the relationships between the pure sciences, agriculture, and agriscience.
	3.	Apply standard ANR safety practices.
Unit 2: The National FFA Organization and Career Development		
	1.	Explore the integral relationship between the FFA and agricultural education.
	2.	Explore the role of the FFA in promoting leadership, personal growth, and career success through 21st century skills standards.
	3.	Describe the role of 21st-century skills, work ethic, and values in establishing and building a successful career.
	4.	Investigate careers associated with the agricultural industry and complete a project with details about a career.
Unit 3: Supervised Agricultural Experience (SAE) for All and Embedded Work-Based Learning		
	1.	Describe the purposes and requirements of the Supervised Agricultural Experience (SAE) for All program.
	2.	Launch a Foundational SAE plan.
	3.	Develop a record-keeping system for an individual student's SAE program.
Unit 4: Science of Animals		
	1.	Explore the animal-agriculture industry and enterprises.
	2.	Compare and contrast animal systems for mammals, avian, and aquatic animals including, but not limited to, respiratory, skeletal, and circulatory.
	3.	Examine the role of reproduction and genetics in agricultural animals.
	4.	Describe important elements of animal nutrition and digestion.
	5.	Explain management practices for maintaining health in beef, dairy, swine, poultry, equine, aquaculture, and other species of local interest.

Unit 5: Science of Plants		
	1.	Examine basic plant classifications.
	2.	Explore the anatomy and physiology of a plant.
	3.	Investigate common methods of plant reproduction.
	4.	Apply principles of plant nutrition.
	5.	Compare and contrast the different components of integrated pest management (IPM) measures.
Unit 6: Soil Science		
	1.	Demonstrate an understanding of the impact of soil as a natural resource.
	2.	Investigate the chemical properties of soils.
Unit 7: Hand and Power Tools in Agriculture		
	1.	Identify and demonstrate the proper use of hand and power tools.
Unit 8: Welding and Cutting Processes		
	1.	Identify common equipment, tools, and safety procedures, and perform the various welding processes.
	2.	Apply safety procedures and perform tasks using oxyacetylene equipment (OAW).
Unit 9: Agricultural Small Engines		
	1.	Apply safety procedures and examine the major parts and function of a small engine.
Unit 10: ANR Careers and FFA Leadership		
	1.	Review safety rules and behavior.
	2.	Investigate and develop skills necessary for pursuing a career in ANR.
	3.	Develop an individual FFA activity plan.
	4.	Develop and present a 3 to 5-minute presentation on an ANR topic.
	5.	Develop an Immersion SAE and maintain records in an electronic record-keeping system.
Unit 11: Conservation and Management of Natural Resources		
	1.	Explore basic concepts of natural resources and conservation management.
	2.	Explore the principles and applications of precision farming operations.
	3.	Explore air and water quality.
	4.	Investigate the use of the land-capability classification system.
Unit 12: Science of Forestry and the Environment		
	1.	Examine basic principles of forest dendrology and mensuration.
	2.	Discuss the relationship of forestry to environmental quality and economic development.

Unit 13: Wildlife and the Environment		
	1.	Examine the relationships of wildlife well-being and environmental quality.
	2.	Explore concepts and practices related to wildlife conservation and management.
	3.	Investigate approaches to protecting and managing wildlife species.
Unit 14: Agricultural Equipment Operation and Maintenance		
	1.	Inspect, maintain, and repair agricultural equipment.
	2.	Perform reconditioning of agricultural machinery and equipment.
Unit 15: Agricultural Construction and Fabrication		
	1.	Select and demonstrate proper equipment for a specific construction job.
	2.	Develop a bill of materials for a specific job.
	3.	Identify and demonstrate electrical procedures and proper use of hand and power tools.
	4.	Perform welds with SMAW equipment.
	5.	Perform welds with GMAW equipment.
	6.	Cut metal with a plasma arc cutter.
Unit 16: Agricultural Business Management and Processes		
	1.	Explore banking services for personal and business accounts.
	2.	Explore concepts of credit.
	3.	Compare loan options.
	4.	Explore basic principles of agricultural economics and marketing.
	5.	Discuss the principles and practices of an agricultural business.

Appendix: Industry Standards

Framework for AFNR Content Standards and Performance Elements Crosswalk for Agricultural and Natural Resources

	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AFNR																	
ABS- Agribusiness Systems		X		X												X	X
AS- Animal Systems		X			X									X			
BS- Biotechnology		X			X	X											
CRP- Career Ready Practices		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CS- AFNR Cluster Skill		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ES- Environmental Service Systems		X					X					X	X	X			
FPP- Food Products and Processing Systems		X			X												
NRS- Natural Resource Systems		X					X					X	X	X			
PS- Plant Systems		X			X	X	X					X	X				
PST- Power, Structural, and Technical Systems		X						X	X	X		X	X		X	X	

AFNR Pathway Content Standards and Performance Elements

The AFNR Pathway Content Standards and Performance Elements are adapted from *National Agriculture, Food, and Natural Resources (AFNR) Career Cluster Content Standards*. Reprinted with permission from the National Council for Agricultural Education, 1410 King St., Suite 400, Alexandria, VA 22314, 800.772.0939. Copyright © 2015. A complete copy of the national standards can be downloaded from the Team Ag Ed Learning Center at thecouncil.ffa.org/afnr

ABS AGRIBUSINESS SYSTEMS
AS ANIMAL SYSTEMS
BS BIOTECHNOLOGY
CRP CAREER READY PRACTICES
CS AGRICULTURE FOOD AND NATURAL RESOURCES CLUSTER SKILL
ES ENVIRONMENTAL SERVICE SYSTEMS
FPP FOOD PRODUCTS AND PROCESSING SYSTEMS
NRS NATURAL RESOURCE SYSTEMS
PS PLANT SYSTEMS
PST POWER, STRUCTURAL, AND TECHNICAL SYSTEMS

Agribusiness Systems Career Pathway Content Standards

The Agribusiness Systems (ABS) Career Pathway encompasses the study of agribusinesses and their management including, but not limited to, record keeping, budget management (cash and credit), and business planning, and sales and marketing. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the planning, development, application and management of agribusiness systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Agribusiness Systems (AG-ABS) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

ABS.01. CCTC Standard: Apply management planning principles in AFNR businesses.

ABS.01.01. Performance Indicator: Apply micro- and macroeconomic principles to plan and manage inputs and outputs in an AFNR business.

ABS.01.02. Performance Indicator: Read, interpret, evaluate and write statements of purpose to guide business goals, objectives and resource allocation.

ABS.01.03. Performance Indicator: Devise and apply management skills to organize and run an AFNR business in an efficient, legal and ethical manner.

ABS.01.04. Performance Indicator: Evaluate, develop and implement procedures used to recruit, train and retain productive human resources for AFNR businesses.

ABS.02. CCTC Standard: Use record keeping to accomplish AFNR business objectives, manage budgets and comply with laws and regulations.

ABS.02.01. Performance Indicator: Apply fundamental accounting principles, systems, tools and applicable laws and regulations to record, track and audit AFNR business transactions (e.g., accounts, debits, credits, assets, liabilities, equity, etc.).

ABS.02.02. Performance Indicator: Assemble, interpret and analyze financial information and reports to monitor AFNR business performance and support decision-making (e.g., income statements, balance sheets, cash-flow analysis, inventory reports, break-even analysis, return on investment, taxes, etc.).

ABS.03. CCTC Standard: Manage cash budgets, credit budgets and credit for an AFNR business using generally accepted accounting principles.

ABS.03.01. Performance Indicator: Develop, assess and manage cash budgets to achieve AFNR business goals.

ABS.03.02. Performance Indicator: Analyze credit needs and manage credit budgets to achieve AFNR business goals.

ABS.04. CCTC Standard: Develop a business plan for an AFNR business.

ABS.04.01. Performance Indicator: Analyze characteristics and planning requirements associated with developing business plans for different types of AFNR businesses.

ABS.04.02. Performance Indicator: Develop production and operational plans for an AFNR business.

ABS.04.03. Performance Indicator: Identify and apply strategies to manage or mitigate risk.

ABS.05. CCTC Standard: Use sales and marketing principles to accomplish AFNR business objectives.

ABS.05.01. Performance Indicator: Analyze the role of markets, trade, competition and price in relation to an AFNR business sales and marketing plans.

ABS.05.02. Performance Indicator: Assess and apply sales principles and skills to accomplish AFNR business objectives.

ABS.05.03. Performance Indicator: Assess marketing principles and develop marketing plans to accomplish AFNR business objectives.

Animal Systems Career Pathway Content Standards

The Animal Systems (AS) Career Pathway encompasses the study of animal systems, including content areas such as life processes, health, nutrition, genetics, and management and processing, as applied to small animals, aquaculture, exotic animals, livestock, dairy, horses and/or poultry. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of animal systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Animal Systems (AG-AS) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

AS.01. CCTC Standard: Analyze historic and current trends impacting the animal systems industry.

AS.01.01. Performance Indicator: Evaluate the development and implications of animal origin, domestication and distribution on production practices and the environment.

- AS.01.02. Performance Indicator:** Assess and select animal production methods for use in animal systems based upon their effectiveness and impacts.
- AS.01.03. Performance Indicator:** Analyze and apply laws and sustainable practices to animal agriculture from a global perspective.
- AS.02. CCTC Standard:** Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.
- AS.02.01. Performance Indicator:** Demonstrate management techniques that ensure animal welfare.
- AS.02.02. Performance Indicator:** Analyze procedures to ensure that animal products are safe for consumption (e.g., use in food system, etc.).
- AS.03. CCTC Standard:** Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production.
- AS.03.01. Performance Indicator:** Analyze the nutritional needs of animals.
- AS.03.02 Performance Indicator:** Analyze feed rations and assess if they meet the nutritional needs of animals.
- AS.03.03 Performance Indicator:** Utilize industry tools to make animal nutrition decisions.
- AS.04. CCTC Standard:** Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.
- AS.04.01. Performance Indicator:** Evaluate animals for breeding readiness and soundness.
- AS.04.02. Performance Indicator:** Apply scientific principles to select and care for breeding animals.
- AS.04.03 Performance Indicator:** Apply scientific principles to breed animals.
- AS.05. CCTC Standard:** Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.
- AS.05.01. Performance Indicator:** Design animal housing, equipment and handling facilities for the major systems of animal production.
- AS.05.02. Performance Indicator:** Comply with government regulations and safety standards for facilities used in animal production.
- AS.06. CCTC Standard:** Classify, evaluate and select animals based on anatomical and physiological characteristics.
- AS.06.01. Performance Indicator:** Classify animals according to taxonomic classification systems and use (e.g. agricultural, companion, etc.).
- AS.06.02. Performance Indicator:** Apply principles of comparative anatomy and physiology to uses within various animal systems.
- AS.06.03. Performance Indicator:** Select and train animals for specific purposes and maximum performance based on anatomy and physiology.
- AS.07. CCTC Standard:** Apply principles of effective animal health care.

AS.07.01. Performance Indicator: Design programs to prevent animal diseases, parasites and other disorders and ensure animal welfare.

AS.07.02. Performance Indicator: Analyze biosecurity measures utilized to protect the welfare of animals on a local, state, national, and global level.

AS.08. CCTC Standard: Analyze environmental factors associated with animal production.

AS.08.01. Performance Indicator: Design and implement methods to reduce the effects of animal production on the environment.

AS.08.02. Performance Indicator: Evaluate the effects of environmental conditions on animals and create plans to ensure favorable environments for animals.

Common Career Technical Core Career Ready Practices Content Standards

The CCTC CRPs encompass fundamental skills and practices that all students should acquire to be career ready such as: responsibility, productivity, healthy choices, maintaining personal finances, communication, decision-making, creativity and innovation, critical-thinking, problem solving, integrity, ethical leadership, management, career planning, technology use and cultural/global competency. Students completing a program of study in any AFNR career pathway will demonstrate the knowledge, skills and behaviors that are important to career ready through experiences in a variety of settings (e.g., classroom, CTSO, work-based learning, community etc.).

DEFINITIONS: Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for CRPs from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** –These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a CTE program of study.

CRP.01. CCTC Standard: Act as a responsible and contributing citizen and employee.

CRP.01.01. Performance Indicator: Model personal responsibility in the workplace and community.

CRP.01.02 Performance Indicator: Evaluate and consider the near-term and long-term impacts of personal and professional decisions on employers and community before taking action.

CRP.01.03. Performance Indicator: Identify and act upon opportunities for professional and civic service at work and in the community.

CRP.02. CCTC Standard: Apply appropriate academic and technical skills.

CRP.02.01. Performance Indicator: Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.

CRP.02.02. Performance Indicator: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.

CRP.03. CCTC Standard: Attend to personal health and financial well-being.

CRP.03.01. Performance Indicator: Design and implement a personal wellness plan.

CRP.03.02. Performance Indicator: Design and implement a personal financial management plan.

CRP.04. CCTC Standard: Communicate clearly, effectively and with reason.

CRP.04.01. Performance Indicator: Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.

CRP.04.02. Performance Indicator: Produce clear, reasoned and coherent written and visual communication in formal and informal settings.

CRP.04.03. Performance Indicator: Model active listening strategies when interacting with others in formal and informal settings.

CRP.05. CCTC Standard: Consider the environmental, social and economic impacts of decisions.

CRP.05.01. Performance Indicator: Assess, identify and synthesize the information and resources needed to make decisions that positively impact the workplace and community.

CRP.05.02. Performance Indicator: Make, defend and evaluate decisions at work and in the community using information about the potential environmental, social and economic impacts.

CRP.06. CCTC Standard: Demonstrate creativity and innovation.

CRP.06.01. Performance Indicator: Synthesize information, knowledge and experience to generate original ideas and challenge assumptions in the workplace and community.

CRP.06.02. Performance Indicator: Assess a variety of workplace and community situations to identify ways to add value and improve the efficiency of processes and procedures.

CRP.06.03. Performance Indicator: Create and execute a plan of action to act upon new ideas and introduce innovations to workplace and community organizations.

CRP.07. CCTC Standard: Employ valid and reliable research strategies.

CRP.07.01. Performance Indicator: Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community.

CRP.07.02. Performance Indicator: Evaluate the validity of sources and data used when considering the adoption of new technologies, practices and ideas in the workplace and community.

CRP.08. CCTC Standard: Utilize critical thinking to make sense of problems and persevere in solving them.

CRP.08.01. Performance Indicator: Apply reason and logic to evaluate workplace and community situations from multiple perspectives.

CRP.08.02. Performance Indicator: Investigate, prioritize and select solutions to solve problems in the workplace and community.

CRP.08.03. Performance Indicator: Establish plans to solve workplace and community problems and execute them with resiliency.

CRP.09. CCTC Standard: Model integrity, ethical leadership and effective management.

CRP.09.01. Performance Indicator: Model characteristics of ethical and effective leaders in the workplace and community (e.g. integrity, self-awareness, self-regulation, etc.).

CRP.09.02. Performance Indicator: Implement personal management skills to function effectively and efficiently in the workplace (e.g., time management, planning, prioritizing, etc.).

CRP.09.03. Performance Indicator: Demonstrate behaviors that contribute to a positive morale and culture in the workplace and community (e.g., positively influencing others, effectively communicating, etc.).

CRP.10. CCTC Standard: Plan education and career path aligned to personal goals.

CRP.10.01. Performance Indicator: Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences.

CRP.10.02. Performance Indicator: Examine career advancement requirements (e.g., education, certification, training, etc.) and create goals for continuous growth in a chosen career.

CRP.10.03. Performance Indicator: Develop relationships with and assimilate input and/or advice from experts (e.g., counselors, mentors, etc.) to plan career and personal goals in a chosen career area.

CRP.10.04. Performance Indicator: Identify, prepare, update and improve the tools and skills necessary to pursue a chosen career path.

CRP.11. CCTC Standard: Use technology to enhance productivity.

CRP.11.01. Performance Indicator: Research, select and use new technologies, tools and applications to maximize productivity in the workplace and community.

CRP.11.02. Performance Indicator: Evaluate personal and organizational risks of technology use and take actions to prevent or minimize risks in the workplace and community.

CRP.12. CCTC Standard: Work productively in teams while using cultural/global competence.

CRP.12.01. Performance Indicator: Contribute to team-oriented projects and builds consensus to accomplish results using cultural global competence in the workplace and community.

CRP.12.02. Performance Indicator: Create and implement strategies to engage team members to work toward team and organizational goals in a variety of workplace and community situations (e.g., meetings, presentations, etc.).

Agriculture, Food, and Natural Resources Cluster Skill Content Standards

The AFNR Cluster Skills (CS) encompasses the study of fundamental knowledge and skills related to all AFNR professions. Students completing a program of study in any AFNR career pathway will demonstrate fundamental knowledge of the nature, scope and relationships of AFNR systems and the skills necessary for analysis of current and historical issues and trends; application of technologies; safety, health and environmental practices; stewardship of natural resources; and exploration of career opportunities.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Agriculture, Food and Natural Resources Career Cluster® (AG) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

CS.01. CCTC Standard: Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.

CS.01.01. Performance Indicator: Research, examine and discuss issues and trends that impact AFNR systems on local, state, national and global levels.

CS.01.02. Performance Indicator: Examine technologies and analyze their impact on AFNR systems.

CS.01.03. Performance Indicator: Identify public policies and examine their impact on AFNR systems.

CS.02. CCTC Standard: Evaluate the nature and scope of the Agriculture, Food & Natural Resources Career Cluster and the role of agriculture, food and natural resources (AFNR) in society and the economy.

CS.02.01. Performance Indicator: Research and use geographic and economic data to solve problems in AFNR systems.

CS.02.02. Performance Indicator: Examine the components of the AFNR systems and assess their impact on the local, state, national and global society and economy.

CS.03. CCTC Standard: Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.

CS.03.01. Performance Indicator: Identify and explain the implications of required regulations to maintain and improve safety, health and environmental management systems.

CS.03.02. Performance Indicator: Develop and implement a plan to maintain and improve health, safety and environmental compliance and performance.

CS.03.03. Performance Indicator: Apply health and safety practices to AFNR workplaces.

CS.03.04. Performance Indicator: Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.

CS.04. CCTC Standard: Demonstrate stewardship of natural resources in AFNR activities.

CS.04.01. Performance Indicator: Identify and implement practices to steward natural resources in different AFNR systems.

CS.04.02. Performance Indicator: Assess and explain the natural resource related trends, technologies and policies that impact AFNR systems.

CS.05. CCTC Standard: Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

CS.05.01. Performance Indicator: Evaluate and implement the steps and requirements to pursue a career opportunity in each of the AFNR career pathways (e.g., goals, degrees, certifications, resumes, cover letter, portfolios, interviews, etc.).

CS.06. CCTC Standard: Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.

CS.06.01. Performance Indicator: Examine and explain foundational cycles and systems of AFNR.

CS.06.02. Performance Indicator: Analyze and explain the connection and relationships between different AFNR systems on a national and global level.

Biotechnology Systems Career Pathway Content Standards

The Biotechnology Systems (BS) Career Pathway encompasses the study of using data and scientific techniques to solve problems concerning living organisms with an emphasis on applications to agriculture, food and natural resource systems. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of biotechnology in the context of AFNR.

Within each pathway, the standards are organized as follows:

- ***National Council for Agricultural Education (NCAE) Standard**** – These are the standards set forth by the National Council for Agricultural Education for Biotechnology Systems. They define what students should know and be able to do after completing instruction in a program of study focused on applying biotechnology to AFNR systems.
- ***Performance Indicators*** – These statements distill each performance element into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related performance element at the conclusion of a program of study in this area.

BS.01. NCAE Standard: Assess factors that have influenced the evolution of biotechnology in

agriculture (e.g., historical events, societal trends, ethical and legal implications, etc.).

BS.01.01. Performance Indicator: Investigate and explain the relationship between past, current and emerging applications of biotechnology in agriculture (e.g., major innovators, historical developments, potential applications of biotechnology, etc.).

BS.01.02. Performance Indicator: Evaluate the scope and implications of regulatory agencies on applications of biotechnology in agriculture and protection of public interests (e.g., health, safety, environmental issues, etc.).

BS.01.03. Performance Indicator: Analyze the relationship and implications of bioethics, laws and public perceptions on applications of biotechnology in agriculture (e.g., ethical, legal, social, cultural issues).

BS.02. NCAE Standard: Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).

BS.02.01. Performance Indicator: Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.

BS.02.02. Performance Indicator: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.

BS.02.03. Performance Indicator: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.

BS.02.04. Performance Indicator: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.

BS.02.05. Performance Indicator: Examine and perform scientific procedures using microbes, DNA, RNA and proteins in a laboratory.

BS.03. NCAE Standard: Demonstrate the application of biotechnology to solve problems in Agriculture, Food and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).

BS.03.01. Performance Indicator: Apply biotechnology principles, techniques and processes to create transgenic species through genetic engineering.

BS.03.02. Performance Indicator: Apply biotechnology principles, techniques and processes to enhance the production of food through the use of microorganisms and enzymes.

BS.03.03. Performance Indicator: Apply biotechnology principles, techniques and processes to protect the environment and maximize use of natural resources (e.g., biomass, bioprospecting, industrial biotechnology, etc.).

BS.03.04. Performance Indicator: Apply biotechnology principles, techniques and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).

BS.03.05. Performance Indicator: Apply biotechnology principles, techniques and processes to produce biofuels (e.g., fermentation, transesterification, methanogenesis, etc.).

BS.03.06. Performance Indicator: Apply biotechnology principles, techniques and processes to improve waste management (e.g., genetically modified organisms, bioremediation, etc.).

Environmental Service Systems Career Pathway Content Standards

The Environmental Service Systems (ESS) Career Pathway encompasses the study of systems, instruments and technology used to monitor and minimize the impact of human activity on environmental systems. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of environmental service systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Environmental Service Systems (AG-ESS) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

ESS.01. CCTC Standard: Use analytical procedures and instruments to manage environmental service systems.

ESS.01.01. Performance Indicator: Analyze and interpret laboratory and field samples in environmental service systems.

ESS.01.02. Performance Indicator: Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).

ESS.02. CCTC Standard: Evaluate the impact of public policies and regulations on environmental service system operations.

ESS.02.01. Performance Indicator: Interpret and evaluate the impact of laws, agencies, policies and practices affecting environmental service systems.

ESS.02.02. Performance Indicator: Compare and contrast the impact of current trends on regulation of environmental service systems (e.g., climate change, population growth, international trade, etc.).

ESS.02.03. Performance Indicator: Examine and summarize the impact of public perceptions and social movements on the regulation of environmental service systems.

ESS.03. CCTC Standard: Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry and ecology.

ESS.03.01. Performance Indicator: Apply meteorology principles to environmental service systems.

ESS.03.02. Performance Indicator: Apply soil science and hydrology principles to environmental service systems.

ESS.03.03. Performance Indicator: Apply chemistry principles to environmental service systems.

ESS.03.04. Performance Indicator: Apply microbiology principles to environmental service systems.

ESS.03.05. Performance Indicator: Apply ecology principles to environmental service systems.

ESS.04. CCTC Standard: Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).

ESS.04.01. Performance Indicator: Use pollution control measures to maintain a safe facility and environment.

ESS.04.02. Performance Indicator: Manage safe disposal of all categories of solid waste in environmental service systems.

ESS.04.03. Performance Indicator: Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations.

ESS.04.04. Performance Indicator: Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental service systems.

ESS.05. CCTC Standard: Use tools, equipment, machinery and technology common to tasks in environmental service systems.

ESS.05.01. Performance Indicator: Use technological and mathematical tools to map land, facilities and infrastructure for environmental service systems.

ESS.05.02. Performance Indicator: Perform assessments of environmental conditions using equipment, machinery and technology.

Food Products and Processing Systems Career Pathway Content Standards

The Food Products and Processing Systems (FPP) Career Pathway encompasses the study of food safety and sanitation; nutrition, biology, microbiology, chemistry and human behavior in local and global food systems; food selection and processing for storage, distribution and consumption; and the historical and current development of the food industry. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of food products and processing systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Food Products and Processing Systems (AG-FPP) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.

- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

FPP.01. CCTC Standard: Develop and implement procedures to ensure safety, sanitation and quality in food product and processing facilities.

FPP.01.01. Performance Indicator: Analyze and manage operational and safety procedures in food products and processing facilities.

FPP.01.02. Performance Indicator: Apply food safety and sanitation procedures in the handling and processing of food products to ensure food quality.

FPP.01.03. Performance Indicator: Apply food safety procedures when storing food products to ensure food quality.

FPP.02. CCTC Standard: Apply principles of nutrition, biology, microbiology, chemistry and human behavior to the development of food products.

FPP.02.01. Performance Indicator: Apply principles of nutrition and biology to develop food products that provide a safe, wholesome and nutritious food supply for local and global food systems.

FPP.02.02. Performance Indicator: Apply principles of microbiology and chemistry to develop food products to provide a safe, wholesome and nutritious food supply for local and global food systems.

FPP.02.03. Performance Indicator: Apply principles of human behavior to develop food products to provide a safe, wholesome and nutritious food supply for local and global food systems.

FPP.03. CCTC Standard: Select and process food products for storage, distribution and consumption.

FPP.03.01. Performance Indicator: Implement selection, evaluation and inspection techniques to ensure safe and quality food products.

FPP.03.02. Performance Indicator: Design and apply techniques of food processing, preservation, packaging and presentation for distribution and consumption of food products.

FPP.03.03. Performance Indicator: Create food distribution plans and procedures to ensure safe delivery of food products.

FPP.04. CCTC Standard: Explain the scope of the food industry and the historical and current developments of food product and processing.

FPP.04.01. Performance Indicator: Examine the scope of the food industry by evaluating local and global policies, trends and customs for food production.

FPP.04.02. Performance Indicator: Evaluate the significance and implications of changes and trends in the food products and processing industry in the local and global food systems.

FPP.04.03. Performance Indicator: Identify and explain the purpose of industry organizations, groups and regulatory agencies that influence the local and global food systems.

Natural Resource Systems Career Pathway Content Standards

The Natural Resource Systems (NRS) Career Pathway encompasses the study of the management, protection, enhancement and improvement of soil, water, wildlife, forests and air as natural resources. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of natural resource systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Natural Resource Systems (AG-NRS) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

NRS.01. CCTC Standard: Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.

NRS.01.01. Performance Indicator: Apply methods of classification to examine natural resource availability and ecosystem function in a particular region.

NRS.01.02. Performance Indicator: Classify different types of natural resources in order to enable protection, conservation, enhancement and management in a particular geographical region.

NRS.01.03. Performance Indicator: Apply ecological concepts and principles to atmospheric natural resource systems.

NRS.01.04. Performance Indicator: Apply ecological concepts and principles to aquatic natural resource systems.

NRS.01.05. Performance Indicator: Apply ecological concepts and principles to terrestrial natural resource systems.

NRS.01.06. Performance Indicator: Apply ecological concepts and principles to living organisms in natural resource systems.

NRS.02. CCTC Standard: Analyze the interrelationships between natural resources and humans.

NRS.02.01. Performance Indicator: Examine and interpret the purpose, enforcement, impact and effectiveness of laws and agencies related to natural resource management, protection, enhancement and improvement (e.g., water regulations, game laws, historic preservation laws, environmental policy, etc.).

NRS.02.02. Performance Indicator: Assess the impact of human activities on the availability of natural resources.

NRS.02.03. Performance Indicator: Analyze how modern perceptions of natural resource management, protection, enhancement and improvement change and develop over time.

NRS.02.04. Performance Indicator: Examine and explain how economics affects the use of natural resources.

NRS.02.05. Performance Indicator: Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources.

NRS.03. CCTC Standard: Develop plans to ensure sustainable production and processing of natural resources.

NRS.03.01. Performance Indicator: Sustainably produce, harvest, process and use natural resource products (e.g., forest products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).

NRS.03.02. Performance Indicator: Demonstrate cartographic skills, tools and technologies to aid in developing, implementing and evaluating natural resource management plans.

NRS.04. CCTC Standard: Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

NRS.04.01. Performance Indicator: Demonstrate natural resource protection, maintenance, enhancement and improvement techniques.

NRS.04.02. Performance Indicator: Diagnose plant and wildlife diseases and follow protocols to prevent their spread.

NRS.04.03. Performance Indicator: Prevent or manage introduction of ecologically harmful species in a particular region.

NRS.04.04. Performance Indicator: Manage fires in natural resource systems.

Plant Science Systems Career Pathway Content Standards

The Plant Systems (PS) Career Pathway encompasses the study of plant life cycles, classifications, functions, structures, reproduction, media and nutrients, as well as growth and cultural practices through the study of crops, turf grass, trees, shrubs and/or ornamental plants. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of plant systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Plant Systems (AG-PS) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.

- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.
- PS.01. CCTC Standard:** Develop and implement a crop management plan for a given production goal that accounts for environmental factors.
- PS.01.01. Performance Indicator:** Determine the influence of environmental factors on plant growth.
- PS.01.02. Performance Indicator:** Prepare and manage growing media for use in plant systems.
- PS.01.03. Performance Indicator:** Develop and implement a fertilization plan for specific plants or crops.
- PS.02. CCTC Standard:** Apply principles of classification, plant anatomy, and plant physiology to plant production and management.
- PS.02.01. Performance Indicator:** Classify plants according to taxonomic systems.
- PS.02.02. Performance Indicator:** Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.
- PS.02.03. Performance Indicator:** Apply knowledge of plant physiology and energy conversion to plant systems.
- PS.03. CCTC Standard:** Propagate, culture and harvest plants and plant products based on current industry standards.
- PS.03.01. Performance Indicator:** Demonstrate plant propagation techniques in plant system activities.
- PS.03.02. Performance Indicator:** Develop and implement a management plan for plant production.
- PS.03.03. Performance Indicator:** Develop and implement a plan for integrated pest management for plant production.
- PS.03.04. Performance Indicator:** Apply principles and practices of sustainable agriculture to plant production.
- PS.03.05. Performance Indicator:** Harvest, handle and store crops according to current industry standards.
- PS.04. CCTC Standard:** Apply principles of design in plant systems to enhance an environment (e.g. floral, forest landscape, and farm).
- PS.04.01. Performance Indicator:** Evaluating, identifying and preparing plants to enhance an environment.
- PS.04.02. Performance Indicator:** Create designs using plants.

Power, Structural and Technical Systems Career Pathway Content Standards

The Power, Structural and Technical Systems (PST) Career Pathway encompasses the study of agricultural equipment, power systems, alternative fuel sources and precision technology, as well as woodworking, metalworking, welding and project planning for agricultural structures. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of power, structural and technical systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- **Common Career Technical Core (CCTC) Standards** – These are the standards for Power, Structural and Technical Systems (AG-PST) from the 2012 version of the Common Career and Technical Core Standards, which are owned by the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation and are used here with permission. These statements define what students should know and be able to do after completing instruction in a program of study for this pathway.
- **Performance Indicators** – These statements distill each CCTC Standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related CCTC Standard at the conclusion of a program of study in this area.

PST.01. CCTC Standard: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

PST.01.01. Performance Indicator: Apply physical science and engineering principles to assess and select energy sources for AFNR power, structural and technical systems.

PST.01.02. Performance Indicator: Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.

PST.01.03. Performance Indicator: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

PST.02. CCTC Standard: Operate and maintain AFNR mechanical equipment and power systems.

PST.02.01. Performance Indicator: Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings.

PST.02.02. Performance Indicator: Operate machinery and equipment while observing all safety precautions in AFNR settings.

PST.03. CCTC Standard: Service and repair AFNR mechanical equipment and power systems.

PST.03.01. Performance Indicator: Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.

PST.03.02. Performance Indicator: Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.

PST.03.03. Performance Indicator: Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).

PST.04. CCTC Standard: Plan, build and maintain AFNR structures.

PST.04.01. Performance Indicator: Create sketches and plans for AFNR structures.

PST.04.02. Performance Indicator: Determine structural requirements, specifications and estimate costs for AFNR structures

PST.04.03. Performance Indicator: Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).

PST.04.04. Performance Indicator: Apply electrical wiring principles in AFNR structures.

PST.05. CCTC Standard: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.

PST.05.01. Performance Indicator: Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.

PST.05.02. Performance Indicator: Prepare and/or use electrical drawings to design, install and troubleshoot electronic control systems in AFNR settings.

PST.05.03. Performance Indicator: Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

