2025 Forestry

Program CIP: 03.0511 — Forestry Technology/Technician

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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

Acknowledgments

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Dr. Lance Evans, State Superintendent of Education, Executive Secretary
Mr. Glen East, Chair
Mr. Matt Miller, Vice-Chair
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Mr. Bill Jacobs
Mr. Mike Pruitt
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Mr. Matt Mayo
Ms. Kate Riddle, Student Representative
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Standards

Standards and alignment crosswalks are referenced in the appendices. 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 Forestry 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)

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College- and Career-Readiness Standards for Science

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
Forestry is a pathway in the Agriculture Career Cluster designed for students interested in careers related to forestry and natural resources. This program provides a solid foundation in forestry principles and practices, preparing students for entry-level employment or further education in forestry, agriculture, agribusiness, or natural resources.

In Forestry I, students gain foundational knowledge in understanding trees and forests, covering topics such as the National FFA Organization, leadership skills, safety practices, and dendrology (the study of trees). The course also introduces forest surveying and mapping techniques and the legal aspects of forestry practices, including interpretations of legal land descriptions and tree and log calculations. Students are also introduced to timber cruising techniques, laying the groundwork for advanced studies.

In Forestry II, students deepen their understanding of timber cruising practices and explore employability skills and career opportunities within the forestry field. The course covers forest types, products, management techniques, timber harvesting, sales strategies, reforestation methods, fire management and safety protocols, and common insect and disease issues. This comprehensive curriculum equips students with the knowledge and skills essential for understanding both the business and ecological aspects of forestry.

Graduates of this program will be prepared for entry-level positions or to pursue further education in forestry, agriculture, agribusiness, or natural resources education, contributing to the sustainable management and stewardship of forest resources.

College, Career, and Certifications
Competencies and suggested performance indicators in the forestry course have been correlated to the National AFNR Career Cluster Content Standards, which 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 a 9^{th}-11^{th} grader. Exceptions to this are a district-level decision based on class size, enrollment numbers, and student maturity. A maximum of 15 students is recommended for both classroom- and lab-based courses.

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
4. 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.

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. **Forestry Introduction—Course Code: 991502**
2. **Forestry Surveying and Measurements—Course Code: 991503**
3. **Forestry Cruising—Course Code: 991504**
4. **Forestry Marketing—Course Code: 991505**

Course Description: Forestry Introduction
Introduction to Forestry lays the groundwork for exploring the world of trees and forests. In this course, students will dive into essential topics including the National FFA Organization, leadership skills, safety practices, and dendrology (the study of trees). Furthermore, students will learn about forest surveying and mapping techniques, which will be essential for their progression into subsequent courses within our comprehensive Forestry program.

Course Description: Forestry Surveying and Measurements
Forestry Surveying and Measurements exposes students to the essential legal aspects of forestry practices. Students will become proficient in interpreting legal land descriptions and mastering tree and log calculations. Additionally, they will be introduced to timber cruising techniques, providing them with valuable skills for further exploration in our Forestry program.

Course Description: Forestry Cruising
Forestry Cruising delves deeper into the art of timber cruise practices. Students will also explore essential employability skills and various career opportunities within the forestry field. This course covers additional topics such as forest types, products, and management techniques, providing a comprehensive understanding of forestry practices and career pathways.

Course Description: Forestry Marketing
Forestry Marketing provides insights into timber harvesting, sales strategies, and reforestation methods. Students will also learn about fire management and safety protocols, along with common insect and disease issues encountered in forestry. This course offers valuable knowledge and skills essential for understanding the business and ecological aspects of forestry, completing the comprehensive Forestry program.

Forestry Introduction—Course Code: 991502

Unit	Unit Title	Hours
1	Exploring the World of Forestry	10
2	The National FFA Organization and Career Development	20
3	Forest Safety	20
4	Tree Growth and Stand Development	10
5	Dendrology	40

6	Forest Traversing and Mapping	40
Total		**140**

Forestry Surveying and Measurements—Course Code: 991503

Unit	Unit Title	Hours
7	Legal Land Descriptions	40
8	Tree and Log Measurements	50
9	Introduction to Timber Cruising	50
Total		**140**

Forestry Cruising—Course Code: 991504

Unit	Unit Title	Hours
10	Forestry Careers and FFA Leadership	30
11	Identifying Forests and Forest Products	20
12	Forest Management Practices	40
13	Advanced Timber Cruising	50
Total		**140**

Forestry Marketing—Course Code: 991505

Unit	Unit Title	Hours
14	Timber Marketing	20
15	Timber Harvesting	20
16	Reforestation	30
17	Forest Fire Management	20
18	Forest Insects and Diseases	10
19	Immersion into FFA and Supervised Agriculture Experience (SAE) for All	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. **Forestry I—Course Code: 991500**
2. **Forestry II—Course Code: 991501**

Course Description: Forestry I
Forestry I provides the foundation for understanding trees and forests, covering essential topics such as the National FFA Organization, leadership skills, safety practices, and dendrology (the study of trees). Students will explore these subjects to gain knowledge and skills vital to their journey in forestry. Additionally, the course will introduce forest surveying and mapping techniques, laying the groundwork for further exploration in Forestry Surveying and Measurements. In this subsequent course, students will delve deeper into the legal aspects of forestry practices, mastering interpretations of legal land descriptions and tree and log calculations. They will also be introduced to timber cruising techniques, enhancing their proficiency, and preparing them for advanced studies within our comprehensive Forestry program.

Course Description: Forestry II
In Forestry II, students will delve deeper into timber cruise practices, gaining a thorough understanding of this crucial aspect of forestry. They will also explore employability skills and various career opportunities within the forestry field, preparing them for future endeavors. Additionally, the course will cover topics such as forest types, products, and management techniques, providing students with a comprehensive understanding of forestry practices and career pathways. Moving on to Forestry Marketing, students will expand their knowledge to include timber harvesting, sales strategies, and reforestation methods. They will also learn about fire management and safety protocols, as well as common insect and disease issues encountered in forestry. Through this course, students will acquire valuable knowledge and skills essential for understanding the business and ecological aspects of forestry, completing their journey through the comprehensive Forestry program.

Forestry I—Course Code: 991500

Unit	Unit Title	Hours
1	Exploring the World of Forestry	10
2	The National FFA Organization and Career Development	20
3	Forest Safety	20
4	Tree Growth and Stand Development	10
5	Dendrology	40
6	Forest Traversing and Mapping	40
7	Legal Land Descriptions	40
8	Tree and Log Measurements	50
9	Introduction to Timber Cruising	50
Total		**280**

Forestry II—Course Code: 991501

Unit	Unit Title	Hours
10	Forestry Careers and FFA Leadership	30
11	Identifying Forests and Forest Products	20
12	Forest Management Practices	40
13	Advanced Timber Cruising	50
14	Timber Marketing	20
15	Timber Harvesting	20
16	Reforestation	30
17	Forest Fire Management	20
18	Forest Insects and Diseases	10
19	Immersion into FFA and Supervised Agriculture Experience (SAE) for All	40
Total		**280**

Career Pathway Outlook

Overview

The Agriculture Career Cluster encompasses a wide range of occupations related to the cultivation and utilization of plants and animals for various purposes, including food, fiber, aesthetics, and environmental conservation. Within this cluster, forestry is a critical sector that involves the management of timber tracts, tree farms, and forest nurseries, as well as the sustainable harvesting of forest products and provision of forestry services. Forestry and conservation workers play a crucial role in assessing and enhancing the health and productivity of forests, typically working for governmental agencies, private forest owners, or forest product companies. In recent years, the forestry industry has witnessed several notable trends shaping career opportunities and job prospects in the field, including a growing emphasis on sustainable forest management practices, technological advancements such as GIS and drones, increased focus on forest carbon sequestration, expanding roles in urban forestry and green infrastructure, and initiatives to promote diversity, equity, and inclusion within the profession. Despite the fluctuations in the economy, forestry remains one of Mississippi's significant commodities, employing a workforce of 69,000 individuals across sectors such as logging, solid wood products, pulp and paper, and wood furniture, underscoring its importance and providing diverse career pathways for those interested in forestry-related occupations.

Needs of the Future Workforce

The future workforce in Mississippi must adapt to emerging trends in agriculture, forestry, and environmental conservation. Conservation scientists and foresters oversee contract negotiations, manage forest lands, prepare sites for new trees, monitor regeneration, suppress forest fires, and collaborate with stakeholders to minimize environmental damage. The U.S. Bureau of Labor Statistics projects a 4% growth in employment for these professionals from 2022 to 2032, with about 3,000 openings annually. In 2022, conservation scientists and foresters held approximately 24,700 and 11,300 jobs, respectively. They work in offices, laboratories, and outdoor environments, sometimes traveling to remote locations. Conservation scientists are typically employed by the federal government (31%), state government (22%), local government (18%), social advocacy organizations (14%), and professional, scientific, and technical services (6%). Foresters are generally employed by state government (27%), federal government (12%), local government (12%), support activities for agriculture and forestry (11%), and forestry and logging (5%). Surveying and mapping technicians also have significant job opportunities in Mississippi, with employment and median salaries in the Gulfport-Biloxi-Pascagoula area (140, $50,160), northeast MS nonmetropolitan area (100, $43,930), and southeast MS nonmetropolitan area (60, $42,840).

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2020	Projected Jobs, 2030	Change (Number)	Change (Percent)	Average Hourly Earnings, (2024)
Conservation Scientists	690	720	30	4.3%	$27.10
First-Line Supervisors of Farming, Fishing, and Forestry Workers	950	1,000	50	5.3%	N/A

Foresters	195	205	10	5.1%	$29.30
Forest and Conservation Technicians	225	235	10	4.4	$23.10
Forestry and Conservation Science Teachers, Postsecondary	45	55	10	22.2	N/A
Logging Equipment Operators	1,675	1,735	60	3.6	$19.00

Source: Mississippi Department of Employment Security; mdes.ms.gov (2024).

Perkins V Requirements and Academic Infusion

The Forestry curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in forestry 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 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 Forestry 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 suggested organization for this course is the National FFA Organization. Contact information for this and other related organizations is listed under the Professional Organizations section of this document.

Cooperative Learning
Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Forestry 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 Forestry curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the Forestry curriculum that will allow and encourage collaboration with professionals currently in the agricultural field.

Work-Based Learning
Work-based learning is an extension of understanding competencies taught in the Forestry classroom. The Forestry program requires students to obtain a minimum of 35 clinical-type hours, which may include but is not limited to, clinicals or worksite field experiences, entrepreneurships, 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, https://www.rcu.msstate.edu/.

Professional Organizations

American Association for Agricultural Education (AAAE)
aaaeonline.org

Association for Career and Technical Education (ACTE)
acteonline.org

Mississippi ACTE
mississippiacte.com

Mississippi FFA/ Mississippi Association of Vocational Agriculture Teachers (MAVAT)
mississippiffa.org

National FFA Organization
ffa.org

National Association of Agricultural Educators (NAAE)
naae.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 Forestry 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 assessed 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: Exploring the World of Forestry

Competencies and Suggested Objectives

1. Explain the importance of forestry. DOK1
   a. Describe the elements of a forest community, including trees, plants, shrubs, soil, water, and animal life.
   b. Describe the importance of trees and forests (including products), employment, climate, air quality, erosion, and recreation.
   c. Describe the amount of forested land, including acres of forestland and acres of commercial land regionally, nationally, and globally,
   d. Investigate the history of forestry, including the importance of forestry to the South and Mississippi.
   e. Identify critical issues affecting the sustainability of forest resources.
      a. Invasive species
      b. Insect and diseases
      c. Natural disasters
      d. Pollution
      e. Deforestation
   f. Explore the importance of forests in the South, including growing season, timber inventory, and economic impact.
   g. Analyze resources considered in multiple-use forest management, including timber, soil, wildlife, recreation, and water.
2. Explain careers in the field of forestry. DOK1
   a. Identify the careers available in the field of forestry.
      a. Urban forestry
      b. General forester
      c. Wildland firefighter
      d. Procurement forester
      e. Mill manager
      f. GIS forester
      g. Wildlife manager
      h. Conservation officer
      i. Environmental engineer
      j. Wildlife biologist
      k. Agricultural education and Extension
      l. Research technician
      m. Aquatic ecologist
   b. Describe educational requirements, job opportunities, duties, and responsibilities for professional, technical, and forestry workers.

Enrichment

<u>The Forest Community</u>

Students will be divided into small groups, each assigned a specific component of the forest community to research, such as trees, shrubs, fungi, or mammals. Each group will conduct

thorough research, summarize their findings, and create an informative and visually appealing one-page fact sheet. They will then prepare and deliver a 5–10-minute presentation to the class, using visual aids to enhance their delivery. Presentations will be evaluated based on a rubric provided in the Teacher Resource Guide, ensuring clarity in expectations. This activity fosters collaborative learning, research skills, and presentation abilities while deepening students' understanding of the interconnectedness within a forest ecosystem.

Forestry Career Paths

Each student will be assigned a specific career within forestry to investigate, focusing on educational requirements, job opportunities, and duties and responsibilities. They will develop a digital slideshow presentation to share their findings with the class. Presentations will be evaluated based on a rubric provided, ensuring students understand the criteria for success. This activity aims to deepen students' understanding of various forestry careers while developing their research and presentation skills.

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 FFA and agricultural education. DOK 2
   a. Discuss and be able to explain 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
   a. Define and describe universally accepted work ethics and values as applied to agricultural, food, and natural resources careers.
      - Trustworthiness
      - Respect
      - Responsibility
      - Fairness
      - Citizenship
   b. 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
   c. Practice work ethic and values in:
      - Forestry classroom and laboratory
      - Student organization activities
      - Experiential learning
      - Work-based learning.
4. Develop a foundational supervised agricultural experience (SAE) and maintain digital records in the state-approved record-keeping system. DOK4

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 3:Forest Safety

Competencies and Suggested Objectives
1. Explain safety practices. DOK 1 a. Describe first aid and first aid equipment used in forestry work. b. Describe job site safety practices, including hazard awareness, safety equipment, safety regulations, prevention of accidents, and appropriate use of personal technology. c. Explain the impact of federal and state safety regulations (such as the Occupational Safety and Health Administration [OSHA]) on forestry operations.
2. Describe environmental hazards, including heat, cold, plants, insects, wildlife, diseases, and topographical hazards. DOK 2 a. Identify characteristics of forest insects and wildlife. b. Explain signs and symptoms of exposure to insects and wildlife.
3. Demonstrate safety practices. DOK 2 a. Apply safety practices to environmental, wildlife, and topographical hazards. b. Apply job site safety practices. c. Discuss types and frequency of forest accidents.
4. Demonstrate proper use of tools, equipment, and personal protective equipment (PPE) based on the equipment accessible in the facility.
5. Explore the potential interactions with other people in the field. a. Identify and discuss interactions in the field. • Conflict Resolution • Establishing Relationships • Situational Awareness

Enrichment

Safety Is As Safety Does

Students will take on the role of safety officers for a large forestry division, responsible for monitoring site safety practices. Using a safety checklist, they will observe and document good and bad safety practices, providing solutions for any identified issues. Their performance will be evaluated based on the safety checklist provided in the Teacher Resource Guide. This activity aims to enhance students' understanding of job site safety in forestry while developing their observational and problem-solving skills.

Safety Regulations

Students will work in teams to develop a poster illustrating the various local, county, state, and federal regulations impacting forestry and forest harvesting in Mississippi. Their posters will be evaluated based on a rubric provided in the Teacher Resource Guide. This activity aims to enhance students' understanding of regulatory frameworks in forestry while fostering teamwork and creativity.

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 4: Tree Growth and Stand Development

Competencies and Suggested Objectives
1. Explain tree physiology. DOK2 a. Describe and identify the main parts of a tree, including trunk, crown, and roots along with their functions. b. Describe and explain tree respiration and photosynthesis, including respiration, transfer of water, minerals, nutrients, and production of food. c. Investigate environmental and biological factors that affect tree growth, including temperature, moisture, light, air, competition, soil, tolerance, and hardiness. d. Explore the methods of tree reproduction, including sprouts, seeds, and suckers. e. Identify characteristics of tree growth, including height and diameter growth.
2. Explain forest stand development. DOK2 a. Differentiate stands according to classifications, including age, size, and composition. b. Identify trees according to crown classes, including dominant, codominant, intermediate, and suppressed.
3. Discuss advances in biotechnology for forestry applications, including grafting, tissue culture, varietals, and genetic improvement. DOK2
4. Discuss the carbon cycle in pine plantations. DOK1

Enrichment
Tour Guide to the Trees Students will assume the role of an urban forester tasked with teaching a forestry seminar to local high school students. They will lead a tour around the campus, identifying factors affecting tree growth, methods of tree reproduction, and characteristics of tree growth, including forest stand classifications and crown classes. During the tour, students will guide the classroom discussion about tree growth characteristics. This activity aims to enhance students' understanding of tree growth and reproduction while developing their presentation and leadership skills. Biotechnology Activity Students will research an application of biotechnology in forestry and summarize their findings. They can choose to give a lecture or create an informative brochure or booklet for educators. Their work will be evaluated based on a rubric provided in the Teacher Resource Guide. This activity aims to deepen students' understanding of biotechnology in forestry while enhancing their research and communication skills.

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 5: Dendrology

Competencies and Suggested Objectives

1. Explain the tree classification system. DOK 2
   a. Identify nomenclature and taxonomy terms.
   b. Identify common names and/or binomial names of trees, including:
      - Loblolly pine—*Pinus taeda*
      - Longleaf pine—*Pinus palustris*
      - Shortleaf pine—*Pinus echinate*
      - Slash pine—*Pinus elliotti*
      - Bald cypress—*Taxodium distichum*
      - Eastern red cedar—*Juniperus virginiana*
      - White oak—*Quercus alba*
      - Southern red oak—*Quercus falcata*
      - Swamp chestnut oak—*Quercus michauxii*
      - Water oak—*Quercus nigra*
      - Cherrybark oak—*Quercus pagoda*
      - Southern live oak—*Quercus virginiana*
      - Mockernut hickory—*Carya tomeutosa*
      - Yellow poplar—*Liriodendron tulipifera*
      - Red maple—*Acer rubrum* cv.
      - Other applicable species listed in the Mississippi FFA CDE Manual/Handbook
2. Identify trees by their characteristics. DOK 2
   a. Describe identifying characteristics and uses of trees, including fruit, leaves, twigs, bark, and tree form.
   b. Collect leaves, fruit, and/or bark samples of species found locally.

Enrichment

Leaf Collection

Students are to collect, preserve, and display leaves and bark of a minimum of 40 local species. All specimens are to be identified by their common and scientific name.

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 6: Forest Traversing and Mapping

Competencies and Suggested Objectives
1. Explain concepts of forest orienteering and traversing. DOK 2 a. Define terms, including bearings, acre, azimuths, chaining, boundary lines, angles, surveying, traversing, latitude, and longitude. b. Describe the importance of surveying to forestry, including timber sales, land measurement, boundary marking, and mapping. c. Identify characteristics of a forest survey, including use of compass, measuring distances, and mapping. d. Identify surveying tools, including compass, chain (metal tape), plumb bob, and range pole. e. Label parts of a compass, including magnetic needle, pivot point, housing, graduated degrees, and sighting mirror. f. Identify and calculate compass measurements and symbols, including azimuths, bearings, and degrees.
2. Perform forestry surveying and mapping techniques. DOK 3 a. Determine the number of paces per chain using common pacing techniques. b. Perform compass, pacing, and chaining skills, including completing a traverse of a selected area. c. Describe and utilize new technologies for forest surveying and mapping to include Unmanned Aircraft Systems (UAS), Global Positioning Systems (GPS) and/or Geographic Information Systems (GIS), and remote sensing.
3. Calculate acreage of forest tracts. DOK 3 a. Determine acreage from new technologies, such as UAS, remote sensing, GPS/GIS, and/or Google Maps. b. Determine acres from traditional methods such as a traverse or grid system.

Enrichment
<u>Forest Surveying</u> Students will take on the role of a surveying team hired to survey a forest for a landowner. They will demonstrate proper techniques for pacing, chaining, and traversing within their group, ensuring accuracy and efficiency. Students will also showcase the various tools used in surveying, such as compasses, measuring tapes, and clinometers, explaining their functions and proper usage. If available, they will demonstrate the use of GPS technology to enhance precision in surveying. This activity aims to provide hands-on experience with essential surveying techniques and tools, enhancing students' practical skills and understanding of forest surveying methods. <u>Athletic Field Measurement Activity</u> Students will measure the acreage of a school athletic field, such as a football field, using three different methods: chaining, GPS, and pacing. They will first demonstrate and use the chaining method, carefully measuring the field with a measuring tape or chain. Next, they will use GPS technology to obtain precise measurements and then apply pacing techniques to estimate the

acreage by walking the field. After collecting data from all three methods, students will compare the results, analyzing the accuracy and reliability of each technique. This activity provides hands-on experience with different measurement methods, enhancing students' practical skills and understanding of surveying and measurement accuracy.

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 7: Legal Land Descriptions

Competencies and Suggested Objectives
1. Describe the United States Public Land Survey System. DOK 2 a. Explain and identify the principal meridians, baselines, and initial points used in Mississippi, including location of these lines on a map. b. Define legal land description terms, including bearing, blaze, hack, contour, elevation, legend, plot, sea level, topographic map, and corner markers. c. Explain reasons and importance for land location in forestry, including retrace, location, and layout of boundaries.
2. Identify information found on maps. DOK 2 a. Interpret information from and demonstrate use of ownership maps. b. Interpret information from and demonstrate use of topographic maps. c. Interpret information from and demonstrate use of GPS/GIS and/or internet map applications.
3. Apply principles of legal land description. DOK 2 a. Write, read, and locate parcels of land using legal land descriptions. b. Observe the records of timber and land deeds located in the chancery clerk's office.

Enrichment

Map It Out

Students will take on the role of cartographers tasked with labeling the principal meridians, baselines, and initial points on a map of Mississippi. They will demonstrate their proficiency in map reading, interpretation, and labeling by accurately completing the assignment for their "employer." Students will carefully identify and mark the specified geographical points on the map, ensuring precision and clarity in their labeling. This activity provides practical experience in mapmaking and geographic literacy, enhancing students' spatial awareness and cartographic skills. Additionally, it fosters critical thinking as students navigate the complexities of geographic features and coordinate systems.

Courthouse Search

Students will step into the role of foresters for a local timber company tasked with locating the legal description for a property they intend to purchase through a bidding process. They will visit the local courthouse and navigate the process of obtaining the legal land description from the chancery clerk's office. Once they have located the document, students will lead a discussion and demonstration on how to write, read, and locate parcels of land using legal land descriptions. Through this hands-on experience, students will deepen their understanding of legal land descriptions and gain practical skills in navigating courthouse records. This activity fosters critical thinking, research abilities, and real-world application of forestry knowledge in land acquisition processes.

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: Tree and Log Measurements

Competencies and Suggested Objectives

1. Explain tree measurement techniques. DOK 2
   a. Define terms, including board feet, basal area, cord, diameter at breast height (DBH), diameter, diameter inside bark (DIB), diameter outside bark (DOB), form class, 1000 board feet (MBF), merchantable height, sawlog, and sawtimber.
   b. Identify tools used in taking tree measurements and associate them with their uses, including D-tape, tree scale stick, bark gauge, distance measuring equipment (DME), tree calipers, wedge prism, clinometer, and increment borer.
   c. Classify DBH measurements into the correct diameter classes, including 1 and 2 in. classes.
   d. Demonstrate the correct location of DBH measurements, including trees on level ground, slopes, leaning, forking, and deformed.
   e. Identify merchantable height, including heights for sawtimber, (10-in. top for hardwood and 8-in. basic top for pine), pulpwood, and specialty products (i.e., pellets, poles, pilings, veneer, etc.).
   f. Distinguish among the major log rules, including Doyle, Scribner, and international log rules.
   g. Draw tally symbols, including dot-tally method.
2. Perform volume measurements of standing timber and sawlogs. DOK 3
   a. Determine the volume of standing timber (board foot/cord volume), volume computation from DBH and height measurements and basal area.
   b. Calculate the board foot of logs, including measuring length and DIB at small end of log to obtain volume and weight scaling of logs for volume.
   c. Calculate the volume of standing timber using traditional methods and available technology.

Enrichment

Timber Tracker Challenge: Measure, Calculate, and Propose

As owner of a forestry consulting firm, you were hired by a landowner to determine the volume of standing timber on their property using traditional methods and/or available technology. In addition to this information, you must measure and tally 10 pulpwood and 10 sawlog trees. From these 20 trees, determine the correct location of DBH measurements and include examples with the following scenarios: level ground, slopes, leaning, forking, and deformed. After these measurements have been taken, calculate the net volume of logs, including measuring length and DIB at small end of log to obtain volume and weight scaling of logs for volume. Return your findings in the form of a typed written proposal to be given to the landowner.

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: Introduction to Timber Cruising

Competencies and Suggested Objectives
1. Describe procedures for cruising timber. DOK 2 a. Discuss terms associated with cruising, including basal area, board foot, bole, circumference, cord, cull, DBH, diameter, DIB, DOB, form class, hypsometer, MBF, merchantable height, sawlog, sawtimber, taper, and whorl. b. Describe reasons for conducting a cruise, including management and procurement. c. Describe factors that determine cruise intensity, including acreage, species, timber density, value, and purpose of cruise.
2. Perform a timber cruise. DOK 3 a. Describe cruising techniques. b. Perform a cruise and volume calculation using traditional methods and/or available technology.

Enrichment
Cruising Activity As a forester for a local company, your assignment is to perform a 100% cruise on a plot of forest. Your performance will be evaluated using the timber cruise rubric in the Teacher Resource Guide.

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: Forestry 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 Forestry. DOK2 a. Discover the careers available in Forestry. 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. Actively participate in the FFA chapter program of activities (POA). DOK3 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 a Forestry 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 digital records in the state-approved record-keeping system.DOK4

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 11: Identifying Forests and Forest Products

Competencies and Suggested Objectives
1. Apply procedures to identify forest types. DOK 2 a. Define terms associated with forest types. b. Distinguish between softwoods and hardwoods, including all characteristics of hardwoods and softwoods. c. Identify forest regions of the United States on a map, including the Pacific Coast, Rocky Mountains, Northern, Central Hardwood, Southern, and Tropical. d. Identify the principal species associated with the forest regions of Mississippi, including oak-pine, oak-gum-cypress, oak-hickory, loblolly pine plantation, loblolly-shortleaf, and longleaf-slash.
2. Apply procedures to identify the physical properties of wood. DOK 2 a. Identify the physical properties of wood according to wood uses, including specific gravity, grain, strength, stiffness, bending, hardness, toughness, ability to be stained, and chemical properties. b. Describe Mississippi wood products' importance to the state and local economies, including sawlogs, pulpwood products, poles and posts, stave, veneer, furniture products, biofuels, biomass fuels, miscellaneous, and byproducts. c. Describe the role of recycling in the forest products industry, including its impact on forest management and harvesting practices.

Enrichment
Forest Fact-Finders: Dive into the Ecosystem Divide students into groups and assign one component of the forest region to each group. The groups should research, summarize, and prepare a fact sheet to be presented to the class. Presentations will be scored based on the presentation rubric found in the Teacher Resource Guide.

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 12: Forest Management Practices

Competencies and Suggested Objectives
1. Explain forest management practices. DOK 2 a. Define terms associated with forest management practices, including best management practices (BMPs) and streamside management zones (SMZs), age classifications, forest management, improvement cutting, selection cutting, timber stand improvement, stand types, wildlife management, and final harvest. b. Identify the role of forest management, including forest crops, management of stands, measurement of stands, goals and objectives of the landowner, and voluntary best management practices. c. Describe forest management practices, including silviculture, reproduction, harvest cuttings, fertilization, prescribed burning, and herbicide application. d. Discuss the Sustainable Forestry Initiative (SFI), including BMPs and SMZs, and potential certifications in these areas. e. Examine the impact of federal and state regulations on issues such as water quality and threatened and endangered species in forest operations.
2. Apply forest management practices. DOK 3 a. Describe the purposes of intermediate cutting in forest management, including maximizing growth, controlling spacing, and removing undesirable trees. b. Determine the type of intermediate cut, including pre-commercial, pulpwood, release, sanitation, and salvage. c. Classify timber stand improvement (TSI) needs, including thinning overstocked stands, prescribed burning, fertilization, herbicide release, sanitation cuts, and salvage cuts.

Enrichment
Field Mission: Craft Your Forest Management Plan Conduct a field trip to evaluate forest management practices, including BMPs and SMZs. Have students record their observations in their journal/notebook. While there, divide students into groups and assign a tract to each group to formulate a forest management plan and present the plan to the class. Use the presentation rubric found in the Teacher Resource Guide.

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 13: Advanced Timber Cruising

Competencies and Suggested Objectives
1. Describe the different types of sampling techniques used in measuring standing timber, including line plot, strip, and prism cruising. DOK 2
2. Plan and conduct a timber cruise. DOK 3 a. Prepare cruise layouts, including the drawing of a diagram describing a 10% sample systematic grid. b. Conduct timber cruises and determine tract volume and values, including 10%, 20%, and 100% samples. c. Discuss and perform point sampling, fixed radius plot, and strip crews.

Enrichment
Cruise Types A local landowner wants to know which cruise method is best for calculating his profits. Conduct a field exercise to participate in timber cruising. You and your crew will conduct a cruise of a given tract of timber. You will calculate the board footage on the tract and compare their findings to the groups. Each group will be given one of the following cruise types: fixed radius plot, point sampling, strip cruise, or 100%. Use the timber cruise rubric in the Teacher Resource Guide.

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 14: Timber Marketing

Competencies and Suggested Objectives
1. Explain timber marketing procedures. DOK 2 a. Define and describe terms associated with timber marketing including harvesting compliance, management prescriptions, grantee, grantor, prospectus, timber sale contract, timber deed, and harvesting contract. b. Describe marketing practices for selling at the highest return, including marking, cruising, determining the value of timber, and selling the timber for the highest price. c. Identify potential markets, financial opportunities, and effects of supply and demand of the following: pulp paper mills, post mills, sawmills, specialty markets, export markets, and firewood sales. d. Determine the highest value of a timber stand, including preparing a prospectus and a timber sale contract.
2. Describe conditions of sale and harvesting of timber. DOK 2 a. Identify desirable postharvest land conditions which may be specified in a harvesting contract. b. Analyze logistics of transporting timber to markets, including proximity to the mill and its effect upon the price received by the producer.

Enrichment
Let's Make a Deal You are a forester for a large paper company. You have been tasked with cruising a large tract of land. In this process, you must prepare the legal documents used in the sale and harvesting of this tract (i.e., prospectus, timber sale contract, timber deed, and harvesting contract). Within this set of documents, the landowner has requested a postharvest land condition line be placed in the harvest contract which will describe the conditions of the property at close of harvest. Also, your company requires you to provide information about logistics and transportation and their effects on timber prices. These reports will be presented to the head forester and will be evaluated by the report rubric from the Teacher Resource Guide.

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: Timber Harvesting

Competencies and Suggested Objectives

1. Explain timber harvesting procedures. DOK 2
   a. Define terms associated with timber harvesting, including harvesting layout, BMPs and SMZs, felling, topping, bunching, skidding, merchandising, loading areas, and hauling.
   b. Describe the methods of harvesting timber, including selection, seed tree, shelterwood, clear-cut, and row thinning.
   c. Identify the products of harvesting, including pulpwood, chip-n-saw, pine poles, veneer, staves, and sawlogs.
2. Develop a timber harvesting plan. DOK 3
   a. Identify types of harvesting equipment, including chainsaws, cutoff saws, delimber, flail delimber, fellerbunchers, prehaulers, skidders, whole tree chippers, loaders, and hauling vehicles.
   b. Observe timber harvesting operations, including total harvest, intermediate harvesting, and forest management practices.
   c. Describe desirable postharvesting land conditions, including condition of nonmerchantable timber, dead trees, treetops, soil cover, and damage caused by logging equipment.
   d. Develop a simple harvesting plan for a given tract of timber.

Enrichment

Methods of Harvesting Research

As an upstart logging company, you are in search of the best harvesting methods. Research and prepare a report on methods of harvesting timber, including selection, seed tree, shelterwood, clear-cut, and mechanical. The written report rubric in the TRD can be used to evaluate the report describing the methods of harvesting timber.

Harvesting Plan

Based on the methods you researched above, select a harvesting method and develop a harvesting plan for a tract of land for which you are bidding. The plan will be presented to the landowner for evaluation using the presentation and/or report rubric in the Teacher Resource Guide.

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: Reforestation

Competencies and Suggested Objectives

1. Explain reforestation practices. DOK 2
   a. Define reforestation terms, including planting tools and site preparation.
   b. Identify the closest sources of tree seedlings.
   c. Describe the methods of handling seedlings, including planting as soon as possible and keeping in cold storage.
   d. Describe the methods of planting, including direct seeding, hand planting, and machine planting.
   e. Describe the different types of site preparation, including roll chop, shearing, burning, chemical, piling, and bedding.
   f. Describe the different types of reforestation.
      - Artificial means
      - Natural means
   g. Describe the economics of reforestation.
   h. Identify federal and state reforestation programs available locally.
2. Perform reforestation practices. DOK 2
   a. Plant seedlings, including using all available methods.
   b. Perform a compliance check, including carrying out a standard Mississippi Forestry Commission compliance check.
   c. Calculate number of seedlings per acre and associated costs needed for reforestation.

Enrichment

Reforestation

Divide the class into groups and have them use the internet or a textbook to research all available federal and state reforestation cost-share programs available to landowners. Have students summarize their findings into fact sheets and distribute to the class.

Seedling Activity

You are a crew foreman on a reforestation job. Demonstrate to your crew seedling planting techniques. After the project is completed, demonstrate procedures for conducting a compliance check to evaluate the planting efforts.

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 17: Forest Fire Management

Competencies and Suggested Objectives

1. Explain forest fire management practices. DOK 2
   a. Define the terms associated with forest fires, including types of fires, fire behavior, fuels, controls, and weather conditions.
   b. Review fire safety protocols.
      - Lookouts-Communications-Escape Routes-Safety (LCES) Zones
      - Personal protective equipment (PPE)
        - Fire retardant clothing
        - Respirator
        - Face shield
        - Hardhat
        - Leather boots
        - Leather gloves
        - Fire shelter
        - Safety glasses
        - Earplugs
   c. Identify the elements of the fire triangle, including heat, fuel, and oxygen.
   d. Identify the classes of fires, including ground, surface, and crown.
   e. Identify the methods of attack, including direct and indirect.
   f. Identify firefighting tools according to their uses, including:
      - Rakes
      - Swatters
      - Cutting tools
      - leaf blowers
      - Chainsaws
      - Backpack sprayer
      - ATV and sprayers
      - Drip torches
      - Fire plows
      - Bulldozers
      - Unmanned Aircraft Systems (UAS)
      - Air support
      - New technology
2. Apply forest fire management techniques. DOK 3
   a. Develop a prescribed burning plan that details fire lanes, weather conditions, wind speed and direction, timber type, fuel conditions, manpower, and procedures for obtaining permission to burn.
   b. Explain the significance of a certified burn manager on the site of all prescribed burns.
   c. Develop a forest fire prevention plan detailing fire lanes, section roads, prescribed burning, preliminary, and emergency notification procedures.

Enrichment
Fire in the Forest: Crafting a Safe and Effective Burn Plan As a county forester, you have been asked to develop a prescribed burning plan for your service area. Create a report discussing the common elements of a prescribed burn plan to present to the county supervisors. In your presentation, be prepared to demonstrate the use of firefighting tools and procedures. Use written report rubric in the Teacher Resource Guide.

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 18: Forest Insects and Diseases

Competencies and Suggested Objectives

1. Identify and discuss forest insects and diseases. DOK 2
   a. Define the terms associated with forest insects and diseases, including wood damage, leaf eaters, wood eaters, epidemic, predator, habitat, diseases, and signs of damage.
   b. Identify the following common insects that affect the forestry industry:
      - Bag Worm
      - Black Turpentine Beetle
      - Cicada
      - Forest Tent Caterpillar
      - Emerald Ash Borer
      - Fall Web Worm
      - Gypsy Moth
      - Ips Engraver Beetle
      - Locust Leafminer
      - Nantucket Pine Tip Moth
      - Pales Weevil
      - Southern Pine Beetle
   c. Identify the following common diseases that affect the forestry industry:
      - Annosus root rot
      - Black knot fungus
      - Brown spot needle blight
      - Cedar apple gall rust
      - Fusiform rust
      - Heart rot
      - Mistletoe
      - Needle cast
      - Oak leaf wilt
      - Verticillium wilt
   d. Identify insect and disease damage and match the damage observed to the origin.
   e. Identify symptoms of insect or disease damage for the following: leaf eaters, wood eaters, sap eaters, phloem eaters, cone borers, root feeders, and terminal feeders.
2. Discuss control methods of forest insects and diseases. DOK 2
   a. Describe the various methods used to control insects and diseases, including direct control and indirect control.
   b. Explain the reasons for identifying insect and disease damage, including prevention of epidemics and loss of timber volume. (e.g., trapping and population monitoring)
   c. Discuss aerial forest detection procedures, including UAS technology, for insect and disease problems.

Enrichment

Timber Troubles: Spotting Pests and Diseases in the Forest

Collect photos of various timber insects, diseases, and associated damage. Include scientific names, common names, development stages, and control methods for each.

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 19: Immersion into FFA and Supervised Agriculture Experience(SAE) for All

Competencies and Suggested Objectives

1. Participate in local, state, and/or national FFA activities that provide opportunities for leadership development and career exploration. DOK3
   a. Actively participate in FFA activities.
      - Leadership Development Events (LDE)
      - Career Development Events (CDE)
        - Land Judging
        - Forestry
        - Environmental and Natural Resources (Envirothon)
        - Equipment and Tool Identification
      - Leadership retreats or conferences
      - Industry-related seminars, workshops, or conferences
      - Other related FFA activities
2. Apply concepts learned from the foundational SAE program to continue the progression of immersion SAEs. DOK4
   a. Redefine and adjust requirements of agreements between students, parents, supervisor, and/or employer.
   b. Update SAE digital records using the state-approved record-keeping system.
      - SAE program goals
      - Student inventory related to the SAE program
      - Expense records
      - Income/gift and scholarship records
      - Skill-attainment records
      - Leadership-activity records and participation in FFA activities
      - Community service hours
      - Student recording of the WBL experiences on the state approved digital record keeping platform.
        - Ensure the hours recorded are evaluated by external supervisor(s) as required by the state of Mississippi.
   c. Complete degree and proficiency award applications as they apply to the SAE.

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.

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: Exploring the World of Forestry		
	1.	Explain the importance of forestry.
	2.	Explain careers in the field of forestry.
Unit 2: The National FFA Organization and Career Development		
	1.	Explore the integral relationship between 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.	Develop a foundational SAE and maintain digital records in the state-approved record-keeping system.
Unit 3: Forest Safety		
	1.	Explain safety practices.
	2.	Describe environmental hazards, including heat, cold, plants, insects, wildlife, diseases, and topographical hazards.
	3.	Demonstrate safety practices.
	4.	Demonstrate proper use of tools, equipment, and personal protective equipment (PPE) based on the equipment accessible in the facility.
	5.	Explore the potential interactions with other people in the field.
Unit 4: Tree Growth and Stand Development		
	1.	Explain tree physiology.
	2.	Explain forest stand development.
	3.	Discuss advances in biotechnology for forestry applications, including grafting, tissue culture, varietals, and genetic improvement.
	4.	Discuss the carbon cycle in pine plantations.
Unit 5: Dendrology		
	1.	Explain the tree classification system.
	2.	Identify trees by their characteristics.
Unit 6: Forest Traversing and Mapping		

	1.	Explain concepts of forest orienteering and traversing.
	2.	Perform forestry surveying and mapping techniques.
	3.	Calculate acreage of forest tracts.
Unit 7: Legal Land Descriptions		
	1.	Describe the United States Public Land Survey System.
	2.	Identify information found on maps.
	3.	Apply principles of legal land description.
Unit 8: Tree and Log Measurements		
	1.	Explain tree measurement techniques.
	2.	Perform volume measurements of standing timber and sawlogs.
Unit 9: Introduction to Timber Cruising		
	1.	Describe procedures for cruising timber.
	2.	Perform a timber cruise.
Unit 10: Forestry Careers and FFA Leadership		
	1.	Review safety rules and behavior.
	2.	Investigate and develop skills necessary for pursuing a career in Forestry.
	3.	Actively participate in the FFA chapter program of activities (POA).
	4.	Develop and present a 3 to 5-minute presentation on a Forestry topic.
	5.	Develop an immersion SAE and maintain digital records in the state-approved record-keeping system.
Unit 11: Identifying Forests and Forest Products		
	1.	Apply procedures to identify forest types.
	2.	Apply procedures to identify the physical properties of wood.
Unit 12: Forest Management Practices		
	1.	Explain forest management practices.
	2.	Apply forest management practices.
Unit 13: Advanced Timber Cruising		
	1.	Describe the different types of sampling techniques used in measuring standing timber, including line plot, strip, and prism cruising.
	2.	Plan and conduct a timber cruise.
Unit 14: Timber Marketing		
	1.	Explain timber marketing procedures.
	2.	Describe conditions of sale and harvesting of timber.
Unit 15: Timber Harvesting		
	1.	Explain timber harvesting procedures.

	2.	Develop a timber harvesting plan.
Unit 16: Reforestation		
	1.	Explain reforestation practices.
	2.	Perform reforestation practices.
Unit 17: Forest and Fire Management		
	1.	Explain forest fire management practices.
	2.	Apply forest fire management techniques.
Unit 18: Forest Insects and Diseases		
	1.	Identify and discuss forest insects and diseases.
	2.	Discuss control methods of forest insects and diseases.
Unit 19: Immersion into FFA and Supervised Agriculture Experience (SAE) for All		
	1.	Participate in local, state, and/or national FFA activities that provide opportunities for leadership development and career exploration.
	2.	Apply concepts learned from the foundational SAE program to continue the progression of immersion SAEs.

Appendix A: 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	17	18	19
Forestry																				
ABS-Agribusiness Systems			X	X		X	X	X						X		X	X	X	X	X
AS-Animal Systems		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
BS-Biotechnology		X	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X
CRP-Career Ready Practices		X	X	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	X		X
ES-Environmental Service Systems		X	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X
FPP-Food Products and Processing Systems		X	X	X	X	X		X						X	X	X				X
NRS-Natural Resource Systems		X	X														X	X	X	X
PS- Plant Systems					X	X										X	X	X	X	X
PST-Power, Structural, and Technical Systems			X	X		X		X	X	X	X	X	X	X	X	X	X	X		X

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ABS Agribusiness 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), 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.

1. ABS.01. CCTC Standard: Apply management planning principles in AFNR businesses.
    a. ABS.01.01. Performance Indicator: Apply micro- and macroeconomic principles to plan and manage inputs and outputs in an AFNR business.
    b. ABS.01.02. Performance Indicator: Read, interpret, evaluate and write statements of purpose to guide business goals, objectives and resource allocation.
    c. ABS.01.03. Performance Indicator: Devise and apply management skills to organize and run an AFNR business in an efficient, legal and ethical manner.
    d. ABS.01.04. Performance Indicator: Evaluate, develop and implement procedures used to recruit, train and retain productive human resources for AFNR businesses.
2. ABS.02. CCTC Standard: Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations.
    a. 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.).
    b. 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.).
3. ABS.03. CCTC Standard: Manage cash budgets, credit budgets, and credit for an AFNR business using generally accepted accounting principles.
    a. ABS.03.01. Performance Indicator: Develop, assess and manage cash budgets to achieve AFNR business goals.

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

4. ABS.04. CCTC Standard: Develop a business plan for an AFNR business.
   a. ABS.04.01. Performance Indicator: Analyze characteristics and planning requirements associated with developing business plans for different types of AFNR businesses.
   b. ABS.04.02. Performance Indicator: Develop production and operational plans for an AFNR business.
   c. ABS.04.03. Performance Indicator: Identify and apply strategies to manage or mitigate risk.
5. ABS.05. CCTC Standard: Use sales and marketing principles to accomplish AFNR business objectives.
   a. ABS.05.01. Performance Indicator: Analyze the role of markets, trade, competition and price in relation to an AFNR business sales and marketing plans.
   b. ABS.05.02. Performance Indicator: Assess and apply sales principles and skills to accomplish AFNR business objectives.
   c. ABS.05.03. Performance Indicator: Assess marketing principles and develop marketing plans to accomplish AFNR business objectives.

AS Animal Systems

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.

1. AS.01. CCTC Standard: Analyze historic and current trends impacting the animal systems industry.
   a. AS.01.01. Performance Indicator: Evaluate the development and implications of animal origin, domestication and distribution on production practices and the environment.
   b. AS.01.02. Performance Indicator: Assess and select animal production methods for use in animal systems based upon their effectiveness and impacts.

    c. AS.01.03. Performance Indicator: Analyze and apply laws and sustainable practices to animal agriculture from a global perspective.
2. AS.02. CCTC Standard: Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.
    a. AS.02.01. Performance Indicator: Demonstrate management techniques that ensure animal welfare.
    b. AS.02.02. Performance Indicator: Analyze procedures to ensure that animal products are safe for consumption (e.g., use in food system, etc.).
3. AS.03. CCTC Standard: Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction, and/or economic production.
    a. AS.03.01. Performance Indicator: Analyze the nutritional needs of animals.
    b. AS.03.02 Performance Indicator: Analyze feed rations and assess if they meet the nutritional needs of animals.
    c. AS.03.03 Performance Indicator: Utilize industry tools to make animal nutrition decisions.
4. AS.04. CCTC Standard: Apply principles of animal reproduction to achieve desired outcomes for performance, development, and/or economic production.
    a. AS.04.01. Performance Indicator: Evaluate animals for breeding readiness and soundness.
    b. AS.04.02. Performance Indicator: Apply scientific principles to select and care for breeding animals.
    c. AS.04.03 Performance Indicator: Apply scientific principles to breed animals.
5. AS.05. CCTC Standard: Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.
    a. AS.05.01. Performance Indicator: Design animal housing, equipment, and handling facilities for the major systems of animal production.
    b. AS.05.02. Performance Indicator: Comply with government regulations and safety standards for facilities used in animal production.
6. AS.06. CCTC Standard: Classify, evaluate, and select animals based on anatomical and physiological characteristics.
    a. AS.06.01. Performance Indicator: Classify animals according to taxonomic classification systems and use (e.g. agricultural, companion, etc.).
    b. AS.06.02. Performance Indicator: Apply principles of comparative anatomy and physiology to uses within various animal systems.
    c. AS.06.03. Performance Indicator: Select and train animals for specific purposes and maximum performance based on anatomy and physiology.
7. AS.07. CCTC Standard: Apply principles of effective animal health care.
    a. AS.07.01. Performance Indicator: Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.
    b. AS.07.02. Performance Indicator: Analyze biosecurity measures utilized to protect the welfare of animals on a local, state, national, and global level.
8. AS.08. CCTC Standard: Analyze environmental factors associated with animal production.

a. AS.08.01. Performance Indicator: Design and implement methods to reduce the effects of animal production on the environment.
b. AS.08.02. Performance Indicator: Evaluate the effects of environmental conditions on animals and create plans to ensure favorable environments for animals.

CRP Career Ready Practices

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.

1. CRP.01. CCTC Standard: Act as a responsible and contributing citizen and employee.
    a. CRP.01.01. Performance Indicator: Model personal responsibility in the workplace and community.
    b. 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.
    c. CRP.01.03. Performance Indicator: Identify and act upon opportunities for professional and civic service at work and in the community.
2. CRP.02. CCTC Standard: Apply appropriate academic and technical skills.
    a. 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.
    b. CRP.02.02. Performance Indicator: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.
3. CRP.03. CCTC Standard: Attend to personal health and financial well-being.
    a. CRP.03.01. Performance Indicator: Design and implement a personal wellness plan.

    b. CRP.03.02. Performance Indicator: Design and implement a personal financial management plan.
4. CRP.04. CCTC Standard: Communicate clearly, effectively and with reason.
    a. CRP.04.01. Performance Indicator: Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.
    b. CRP.04.02. Performance Indicator: Produce clear, reasoned and coherent written and visual communication in formal and informal settings.
    c. CRP.04.03. Performance Indicator: Model active listening strategies when interacting with others in formal and informal settings.
5. CRP.05. CCTC Standard: Consider the environmental, social and economic impacts of decisions.
    a. CRP.05.01. Performance Indicator: Assess, identify and synthesize the information and resources needed to make decisions that positively impact the workplace and community.
    b. 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.
6. CRP.06. CCTC Standard: Demonstrate creativity and innovation.
    a. CRP.06.01. Performance Indicator: Synthesize information, knowledge and experience to generate original ideas and challenge assumptions in the workplace and community.
    b. 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.
    c. 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.
7. CRP.07. CCTC Standard: Employ valid and reliable research strategies.
    a. CRP.07.01. Performance Indicator: Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community.
    b. 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.
8. CRP.08. CCTC Standard: Utilize critical thinking to make sense of problems and persevere in solving them.
    a. CRP.08.01. Performance Indicator: Apply reason and logic to evaluate workplace and community situations from multiple perspectives.
    b. CRP.08.02. Performance Indicator: Investigate, prioritize and select solutions to solve problems in the workplace and community.
    c. CRP.08.03. Performance Indicator: Establish plans to solve workplace and community problems and execute them with resiliency.
9. CRP.09. CCTC Standard: Model integrity, ethical leadership and effective management.

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

10. CRP.10. CCTC Standard: Plan education and career path aligned to personal goals.
    a. CRP.10.01. Performance Indicator: Identify career opportunities within a Career Cluster that match personal interests, talents, goals and preferences.
    b. 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.
    c. 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.
    d. CRP.10.04. Performance Indicator: Identify, prepare, update and improve the tools and skills necessary to pursue a chosen career path.
11. CRP.11. CCTC Standard: Use technology to enhance productivity.
    a. CRP.11.01. Performance Indicator: Research, select and use new technologies, tools and applications to maximize productivity in the workplace and community.
    b. 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.
12. CRP.12. CCTC Standard: Work productively in teams while using cultural/global competence.
    a. 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.
    b. 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.).

CS Agriculture Food and Natural Resources Cluster Skill

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.

1. CS.01. CCTC Standard: Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.
    a. CS.01.01. Performance Indicator: Research, examine, and discuss issues and trends that impact AFNR systems on local, state, national, and global levels.
    b. CS.01.02. Performance Indicator: Examine technologies and analyze their impact on AFNR systems.
    c. CS.01.03. Performance Indicator: Identify public policies and examine their impact on AFNR systems.
2. 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.
    a. CS.02.01. Performance Indicator: Research and use geographic and economic data to solve problems in AFNR systems.
    b. 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.
3. CS.03. CCTC Standard: Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.
    a. CS.03.01. Performance Indicator: Identify and explain the implications of required regulations to maintain and improve safety, health and environmental management systems.
    b. CS.03.02. Performance Indicator: Develop and implement a plan to maintain and improve health, safety and environmental compliance and performance.
    c. CS.03.03. Performance Indicator: Apply health and safety practices to AFNR workplaces.
    d. CS.03.04. Performance Indicator: Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.
4. CS.04. CCTC Standard: Demonstrate stewardship of natural resources in AFNR activities.
    a. CS.04.01. Performance Indicator: Identify and implement practices to steward natural resources in different AFNR systems.
    b. CS.04.02. Performance Indicator: Assess and explain the natural resource related trends, technologies and policies that impact AFNR systems.

5. CS.05. CCTC Standard: Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.
    a. 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.).
6. 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.
    a. CS.06.01. Performance Indicator: Examine and explain foundational cycles and systems of AFNR.
    b. CS.06.02. Performance Indicator: Analyze and explain the connection and relationships between different AFNR systems on a national and global level.

BS Biotechnology

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.

1. 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.).
    a. 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.).
    b. 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.).

c. 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).

2. 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.).
   a. BS.02.01. Performance Indicator: Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.
   b. BS.02.02. Performance Indicator: Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.
   c. BS.02.03. Performance Indicator: Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.
   d. BS.02.04. Performance Indicator: Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.
   e. BS.02.05. Performance Indicator: Examine and perform scientific procedures using microbes, DNA, RNA and proteins in a laboratory.
3. 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.).
   a. BS.03.01. Performance Indicator: Apply biotechnology principles, techniques, and processes to create transgenic species through genetic engineering.
   b. BS.03.02. Performance Indicator: Apply biotechnology principles, techniques and processes to enhance the production of food through the use of microorganisms and enzymes.
   c. 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.).
   d. 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.).
   e. BS.03.05. Performance Indicator: Apply biotechnology principles, techniques, and processes to produce biofuels (e.g., fermentation, transesterification, methanogenesis, etc.).
   f. BS.03.06. Performance Indicator: Apply biotechnology principles, techniques, and processes to improve waste management (e.g., genetically modified organisms, bioremediation, etc.).

ES Environmental Service Systems

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.

1. ESS.01. CCTC Standard: Use analytical procedures and instruments to manage environmental service systems.
    a. ESS.01.01. Performance Indicator: Analyze and interpret laboratory and field samples in environmental service systems.
    b. ESS.01.02. Performance Indicator: Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).
2. ESS.02. CCTC Standard: Evaluate the impact of public policies and regulations on environmental service system operations.
    a. ESS.02.01. Performance Indicator: Interpret and evaluate the impact of laws, agencies, policies and practices affecting environmental service systems.
    b. 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.).
    c. ESS.02.03. Performance Indicator: Examine and summarize the impact of public perceptions and social movements on the regulation of environmental service systems.
3. 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.
    a. ESS.03.01. Performance Indicator: Apply meteorology principles to environmental service systems.
    b. ESS.03.02. Performance Indicator: Apply soil science and hydrology principles to environmental service systems.
    c. ESS.03.03. Performance Indicator: Apply chemistry principles to environmental service systems.
    d. ESS.03.04. Performance Indicator: Apply microbiology principles to environmental service systems.
    e. ESS.03.05. Performance Indicator: Apply ecology principles to environmental service systems.

4. 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).
    a. ESS.04.01. Performance Indicator: Use pollution control measures to maintain a safe facility and environment.
    b. ESS.04.02. Performance Indicator: Manage safe disposal of all categories of solid waste in environmental service systems.
    c. 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.
    d. 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.
5. ESS.05. CCTC Standard: Use tools, equipment, machinery, and technology common to tasks in environmental service systems.
    a. ESS.05.01. Performance Indicator: Use technological and mathematical tools to map land, facilities and infrastructure for environmental service systems.
    b. ESS.05.02. Performance Indicator: Perform assessments of environmental conditions using equipment, machinery and technology.

FPP Food Products and Processing Systems

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.

1. FPP.01. CCTC Standard: Develop and implement procedures to ensure safety, sanitation and quality in food product and processing facilities.
    a. FPP.01.01. Performance Indicator: Analyze and manage operational and safety procedures in food products and processing facilities.

b. FPP.01.02. Performance Indicator: Apply food safety and sanitation procedures in the handling and processing of food products to ensure food quality.
c. FPP.01.03. Performance Indicator: Apply food safety procedures when storing food products to ensure food quality.

2. FPP.02. CCTC Standard: Apply principles of nutrition, biology, microbiology, chemistry, and human behavior to the development of food products.
   a. 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.
   b. 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.
   c. 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.
3. FPP.03. CCTC Standard: Select and process food products for storage, distribution, and consumption.
   a. FPP.03.01. Performance Indicator: Implement selection, evaluation, and inspection techniques to ensure safe and quality food products.
   b. FPP.03.02. Performance Indicator: Design and apply techniques of food processing, preservation, packaging, and presentation for distribution and consumption of food products.
   c. FPP.03.03. Performance Indicator: Create food distribution plans and procedures to ensure safe delivery of food products.
4. FPP.04. CCTC Standard: Explain the scope of the food industry and the historical and current developments of food product and processing.
   a. FPP.04.01. Performance Indicator: Examine the scope of the food industry by evaluating local and global policies, trends and customs for food production.
   b. 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.
   c. 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.

NRS Natural Resource 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.

1. 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.
    a. NRS.01.01. Performance Indicator: Apply methods of classification to examine natural resource availability and ecosystem function in a particular region.
    b. 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.
    c. NRS.01.03. Performance Indicator: Apply ecological concepts and principles to atmospheric natural resource systems.
    d. NRS.01.04. Performance Indicator: Apply ecological concepts and principles to aquatic natural resource systems.
    e. NRS.01.05. Performance Indicator: Apply ecological concepts and principles to terrestrial natural resource systems.
    f. NRS.01.06. Performance Indicator: Apply ecological concepts and principles to living organisms in natural resource systems.
2. NRS.02. CCTC Standard: Analyze the interrelationships between natural resources and humans.
    a. 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.).
    b. NRS.02.02. Performance Indicator: Assess the impact of human activities on the availability of natural resources.
    c. NRS.02.03. Performance Indicator: Analyze how modern perceptions of natural resource management, protection, enhancement, and improvement change and develop over time.
    d. NRS.02.04. Performance Indicator: Examine and explain how economics affects the use of natural resources.
    e. NRS.02.05. Performance Indicator: Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources.
3. NRS.03. CCTC Standard: Develop plans to ensure sustainable production and processing of natural resources.
    a. 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.).

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

4. NRS.04. CCTC Standard: Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.
   a. NRS.04.01. Performance Indicator: Demonstrate natural resource protection, maintenance, enhancement and improvement techniques.
   b. NRS.04.02. Performance Indicator: Diagnose plant and wildlife diseases and follow protocols to prevent their spread.
   c. NRS.04.03. Performance Indicator: Prevent or manage introduction of ecologically harmful species in a particular region.
   d. NRS.04.04. Performance Indicator: Manage fires in natural resource systems.

PS Plant 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 wells 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.

1. PS.01. CCTC Standard: Develop and implement a crop management plan for a given production goal that accounts for environmental factors.
   a. PS.01.01. Performance Indicator: Determine the influence of environmental factors on plant growth.
   b. PS.01.02. Performance Indicator: Prepare and manage growing media for use in plant systems.
   c. PS.01.03. Performance Indicator: Develop and implement a fertilization plan for specific plants or crops.
2. PS.02. CCTC Standard: Apply principles of classification, plant anatomy, and plant physiology to plant production and management.
   a. PS.02.01. Performance Indicator: Classify plants according to taxonomic systems.
   b. PS.02.02. Performance Indicator: Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

c. PS.02.03. Performance Indicator: Apply knowledge of plant physiology and energy conversion to plant systems.

3. PS.03. CCTC Standard: Propagate, culture and harvest plants and plant products based on current industry standards.
   a. PS.03.01. Performance Indicator: Demonstrate plant propagation techniques in plant system activities.
   b. PS.03.02. Performance Indicator: Develop and implement a management plan for plant production.
   c. PS.03.03. Performance Indicator: Develop and implement a plan for integrated pest management for plant production.
   d. PS.03.04. Performance Indicator: Apply principles and practices of sustainable agriculture to plant production.
   e. PS.03.05. Performance Indicator: Harvest, handle and store crops according to current industry standards.
4. PS.04. CCTC Standard: Apply principles of design in plant systems to enhance an environment (e.g. floral, forest landscape, and farm).
   a. PS.04.01. Performance Indicator: Evaluating, identifying, and preparing plants to enhance an environment.
   b. PS.04.02. Performance Indicator: Create designs using plants.

PST Power, Structural, and Technical Systems

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.

1. PST.01. CCTC Standard: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
   a. PST.01.01. Performance Indicator: Apply physical science and engineering principles to assess and select energy sources for AFNR power, structural and technical systems.

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

2. PST.02. CCTC Standard: Operate and maintain AFNR mechanical equipment and power systems.
   a. PST.02.01. Performance Indicator: Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.
   b. PST.02.02. Performance Indicator: Operate machinery and equipment while observing all safety precautions in AFNR settings.
3. PST.03. CCTC Standard: Service and repair AFNR mechanical equipment and power systems.
   a. PST.03.01. Performance Indicator: Troubleshoot, service, and repair components of internal combustion engines using manufacturers' guidelines.
   b. 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.
   c. 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.).
4. PST.04. CCTC Standard: Plan, build, and maintain AFNR structures.
   a. PST.04.01. Performance Indicator: Create sketches and plans for AFNR structures.
   b. PST.04.02. Performance Indicator: Determine structural requirements, specifications and estimate costs for AFNR structures.
   c. 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.).
   d. PST.04.04. Performance Indicator: Apply electrical wiring principles in AFNR structures.
5. PST.05. CCTC Standard: Use control, monitoring, geospatial, and other technologies in AFNR power, structural and technical systems.
   a. 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.
   b. PST.05.02. Performance Indicator: Prepare and/or use electrical drawings to design, install, and troubleshoot electronic control systems in AFNR settings.
   c. PST.05.03. Performance Indicator: Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.

CSS1-21st Century Themes
CS1 Global Awareness

1. Using 21st century skills to understand and address global issues.
2. Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts.
3. Understanding other nations and cultures, including the use of non-English languages.

CS2 Financial, Economic, Business, and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

1. Demonstrating knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems
2. Demonstrating knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigating and analyzing environmental issues and make accurate conclusions about effective solutions
4. Taking individual and collective action toward addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

1. Think creatively
2. Work creatively with others
3. Implement innovations

CS7 Critical Thinking and Problem Solving

1. Reason effectively
2. Use systems thinking
3. Make judgments and decisions

4. Solve problems

CS8 Communication and Collaboration

1. Communicate clearly
2. Collaborate with others

CSS3-Information, Media and Technology Skills

CS9 Information Literacy

1. Access and evaluate information
2. Use and manage information

CS10 Media Literacy

1. Analyze media
2. Create media products

CS11 ICT Literacy

1. Apply technology effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability

1. Adapt to change
2. Be flexible

CS13 Initiative and Self-Direction

1. Manage goals and time
2. Work independently
3. Be self-directed learners

CS14 Social and Cross-Cultural Skills

1. Interact effectively with others
2. Work effectively in diverse teams

CS15 Productivity and Accountability

1. Manage projects
2. Produce results

CS16 Leadership and Responsibility

1. Guide and lead others
2. Be responsible to others

Appendix B: Academic Standards

2018 Mississippi College and Career-Readiness Standards for Biology

	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Forestry																				
BIO1-Cells as a system		X	X		X				X	X	X	X	X			X	X		X	X
BIO2-Energy Transfer		X	X	X	X	X			X		X	X	X			X	X		X	X
BIO3-Reproduction and Heredity			X		X		X			X	X			X			X			X
BIO4-Adaptations and Evolution		X	X		X	X	X				X	X		X			X	X	X	X
BIO5-Interdependence of Organisms and Their Environment		X	X		X				X		X	X	X						X	X

BIO.1A Students will demonstrate an understanding of the characteristics of life and biological organization.

BIO.1B Students will analyze the structure and function of the macromolecules that make up cells.

BIO.1C Students will relate the diversity of organelles to a variety of specialized cellular functions.

BIO.1D Students will describe the structure of the cell membrane and analyze how the structure is related to its primary function of regulating transport in and out of cells to maintain homeostasis.

BIO.1E Students will develop and use models to explain the role of the cell cycle during growth, development, and maintenance in multicellular organisms.

BIO.2 Students will explain that cells transform energy through the processes of photosynthesis and cellular respiration to drive cellular functions.

BIO.3A Students will develop and use models to explain the role of meiosis in the production of haploid gametes required for sexual reproduction.

BIO.3B Students will analyze and interpret data collected from probability calculations to explain the variation of expressed traits within a population.

BIO.3C Students will construct an explanation based on evidence to describe how the structure and nucleotide base sequence of DNA determines the structure of proteins or RNA that carry out essential functions of life.

BIO.4 Students will analyze and interpret evidence to explain the unity and diversity of life.

BIO.5 Students will Investigate and evaluate the interdependence of living organisms and their environment.