2021 Horticulture

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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 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.

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Acknowledgments

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Standards

Standards and alignment crosswalks are referenced in the appendix. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, English II, and U.S. History from 1877, which could be integrated into the content of the units. Mississippi's CTE horticulture curriculum 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. A complete copy of the standards can be accessed at thecouncil.ffa.org/afnr. The National AFNR Career Cluster Content Standards are copyrighted to the National Council for Agricultural Education and are used by permission.

International Society for Technology in Education Standards (ISTE)

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iste.org

College- and Career-Ready Standards

College- and career-readiness standards emphasize critical thinking, teamwork, and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College and Career Ready 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. 21 *Framework Definitions* (2019).
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, call the RCU at 662.325.2510.

Executive Summary

Pathway Description
Horticulture is a pathway in the agriculture, food, and natural resources career cluster. This program is designed for students who wish to pursue entry-level employment or continuing education in a wide variety of fields in the horticulture industry. Topics covered in the two-year program include plant structure and growth; plant propagation; pest management; floristry; greenhouse crops and management; olericulture; plantscaping; landscape design, installation, and management; and turfgrass management.

College, Career, and Certifications
No national industry-recognized certifications are known to exist at this time in the field of horticulture. Competencies and suggested performance indicators in the horticulture courses have been correlated, however, to the *AFNR Career Cluster Content Standards* that have been reviewed and endorsed at the national level by the National Council on Agricultural Education.

Grade Level and Class Size Recommendations
It is recommended that students enter this program as a ninth 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 and TABE reading score (eighth grade or higher)

or

1. TABE reading and math score (eighth grade or higher)
2. Instructor approval

or

a. Instructor approval

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

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

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

Professional Learning
If you have specific questions about the content of any of training sessions provided, please contact the RCU at 662.325.2510.

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. **Introduction to Horticulture—Course Code: 991402**
2. **Horticulture Plant Processes—Course Code: 991403**
3. **Horticulture Nursery—Course Code: 991404**
4. **Horticulture Landscape and Turfgrass—Course Code: 991405**

Course Description: Introduction to Horticulture
This course teaches students about horticulture orientation and leadership development. Students are introduced to basic plant and soil sciences (plant structure and growth). This course also focuses on horticulture structures.

Course Description: Horticulture Plant Processes
This course focuses on plant propagation, principles of pest management, greenhouse crops, and olericulture production.

Course Description: Horticulture Nursery
This course is a comprehensive course that reviews leadership, careers, and safety. It also introduces students to nursery and landscape plant identification, horticulture marketing, and business procedures, as well as container and field crop production.

Course Description: Horticulture Landscape and Turfgrass
This course covers the concepts of landscape design, installation, construction, and maintenance. Students will learn skills and knowledge associated with turfgrass installation and maintenance, pomology production, and basic principles of floristry.

Introduction to Horticulture—Course Code: 991402

Unit	Unit Name	Hours
1	Horticulture Orientation and Leadership Development	15
2	Horticulture Safety	15
3	Basic Plant Structure and Function	35
4	Plant Media	30
5	Horticulture Structures	15
Total		110

Horticulture Plant Processes—Course Code: 991403

Unit	Unit Name	Hours
6	Plant Propagation	35
7	Principles of Pest Management	30
8	Greenhouse Crops and Olericulture Production	40
Total		105

Horticulture Nursery—Course Code: 991404

Unit	Unit Name	Hours
9	Leadership, Careers, and Safety	15
10	Nursery and Landscape Plant Identification	25
11	Horticulture Marketing and Business Procedures	30
12	Container and Field Crop Production	30
Total		100

Horticulture Landscape and Turfgrass—Course Code: 991405

Unit	Unit Name	Hours
13	Landscape Design, Installation, Construction, and Maintenance	55
14	Turfgrass Installation and Maintenance	25
15	Principles of Floristry	25
16	Pomology Production	10
Total		115

Option 2—Two 2-Carnegie Unit Courses

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

1. **Horticulture I—Course Code: 991400**
2. **Horticulture II—Course Code: 991401**

Course Description: Horticulture I
This course introduces students to basic plant and soil sciences (plant structure and growth). It focuses on horticulture structures, plant propagation, and principles of pest management. It also covers greenhouse crops and olericulture production.

Course Description: Horticulture II
This course reviews leadership, careers, and safety in the horticulture field. It introduces students to plant identification, horticulture marketing and business procedures, and container and field crop production. It includes concepts of landscape design, installation, construction, and maintenance. Students are introduced to turfgrass installation and maintenance, pomology, and basic principles of floristry.

Horticulture I—Course Code: 991400

Unit	Unit Name	Hours
1	Horticulture Orientation and Leadership Development	15
2	Horticulture Safety	15
3	Basic Plant Structure and Function	35
4	Plant Media	30
5	Horticulture Structures	15
6	Plant Propagation	35
7	Principles of Pest Management	30
8	Greenhouse Crops and Olericulture Production	40
Total		215

Horticulture II—Course Code: 991401

Unit	Unit Name	Hours
9	Leadership, Careers, and Safety	15
10	Nursery and Landscape Plant Identification	25
11	Horticulture Marketing and Business Procedures	30
12	Container and Field Crop Production	30
13	Landscape Design, Installation, Construction, and Maintenance	55
14	Turfgrass Installation and Maintenance	25
15	Principles of Floristry	25
16	Pomology Production	10
Total		215

Career Pathway Outlook

Overview

Horticulture is a science that focuses on the commercial production of specialty crops that help sustain and enrich our lives by providing nutritious food, enhancing the beauty of our homes and communities, and reducing our carbon footprint. These specialty crops include fruits, vegetables, ornamental plants, and turfgrass. A shortlist of places horticulturists may work includes labs, floral shops, arboretums, garden centers, and golf courses. Careers fields in horticulture include landscape design, golf and sports turf management, teaching, and research. Many with a background in horticulture start their own businesses.

Most careers in horticulture require at least an associate degree, although careers with the highest earning potential—scientists and postsecondary teachers, for example—usually require advanced degrees.

Needs of the Future Workforce

Careers in horticulture are projected to grow as research into agricultural production methods and techniques continues. Data for this synopsis were compiled from employment projections prepared by the U.S. Census Bureau, the U.S. Bureau of Labor Statistics (2020), and the Mississippi Department of Employment Security (2020).

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2016	Projected Jobs, 2026	Change (Number)	Change (Percent)	Average Hourly Earnings (2019)
Food Scientists and Technologists	40	50	10	25	$28.05
Agricultural and Food Science Technicians	260	270	10	3.9	$18.18
Agricultural Sciences Teachers, Postsecondary	150	160	10	6.7	NA
Soil and Plant Scientists	110	110	0	0	$43.61
Farm and Home Management Advisors	290	300	10	3.5	$23.73
Landscaping and Groundskeeping Workers	6,000	6,620	620	10.3	$12.46
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	980	1,090	110	11.2	$18.22

Source: Mississippi Department of Employment Security; mdes.ms.gov (2019).

Perkins V Requirements and Academic Infusion
The horticulture curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in horticulture fields. It also offers students a program of study, including secondary, postsecondary, and institutions of higher learning courses, that will further prepare them for careers in horticulture. 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 horticulture 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 opportunity to succeed.

CTE Student Organizations

Teachers should investigate opportunities to sponsor a student organization. There are several in Mississippi that will foster the types of learning expected from the horticulture curriculum. The National FFA Organization is the student organization for horticulture. FFA provides students with growth opportunities and competitive events and also opens the doors to the world of agriculture and scholarship opportunities.

Cooperative Learning

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

Work-Based Learning

Work-based learning is an extension of understanding competencies taught in the horticulture classroom. This curriculum is designed in a way that necessitates active involvement by the students in the community around them and the global environment. These real-world connections and applications link to all types of students to knowledge, skills, and professional dispositions. Work-based learning should encompass ongoing and increasingly more complex involvement with local companies and horticulture professionals. Thus, supervised collaboration and immersion into the horticulture industry around the students are keys to students' success, knowledge, and skills development.

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

Suggested Time on Task
This section indicates an estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80% of the time in the course. The remaining percentage of class time will include instruction in nontested material, review for end-of-course testing, and special projects.

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
Teacher resources for this curriculum may be found in multiple places. Many program areas have teacher resource documents that accompany the curriculum and can be downloaded from the same site as the curriculum. The teacher resource document contains references, lesson ideas, websites, teaching and assessment strategies, scenarios, skills to master, and other resources divided by unit. This document could be updated periodically by RCU staff. Please check the entire document, including the entries for each unit, regularly for new information. If you have something you would like to add or have a question about the document, call or email the RCU's instructional design specialist for your program. The teacher resource document can be downloaded at rcu.msstate.edu/curriculum/curriculumdownload.aspx. All teachers should request to be added to the Canvas Resource Guide for their course. This is where all resources will be housed in the future, if they are not already. 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
Many of the units include an enrichment section at the end. If the horticulture program is currently using the Mississippi Career Planning and Assessment System (MS-CPAS) as a measure of accountability, the enrichment section of material will not be tested. If this is the case, it is suggested to use the enrichment material when needed or desired by the teacher and if time allows in the class. This material will greatly enhance the learning experiences for students. If, however, the horticulture program is using a national certification or other measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be tested. It is the responsibility of the teacher to ensure all competencies for the selected assessment are covered throughout the year.

Unit 1: Horticulture Orientation and Leadership Development

Competencies and Suggested Objectives

1. Identify school and program policies and procedures related to the horticulture program.[DOK1]
   a. Describe local program and career technical center policies and procedures including dress code, attendance, academic requirements, discipline, the school technology acceptable use policy, and horticulture regulations.
   b. Define and describe universally accepted ethics and values as applied to horticulture careers.
   c. Practice ethics and values in the horticulture classroom and lab.

2. Develop life and career skills for success in the 21st century. [DOK3]
   a. Identify, describe, and apply essential life and career skills/traits.
      - Communication
      - Considerate
      - Cooperation
      - Dependability
      - Effective listening
      - Empathy
      - Enthusiasm
      - Gets along with others
      - Good manners
      - Honesty
      - Humility
      - Interpersonal skills
      - Loyalty
      - Open-minded
      - Positive self-concept
      - Problem-solver
      - Rational thinking
      - Respect for others
      - Responsibility
      - Self-motivated/determined
      - Sets priorities
      - Teamwork
      - Trustworthy
      - Work ethic
   b. Explain the role of effective leadership.
   c. Apply the concepts of team building and team member participation.
   d. Self-evaluate students' personal leadership traits and develop a plan for improvement.
   e. Demonstrate basic parliamentary procedures (e.g., conduct a meeting, state a main motion, vote on a motion, understand the use of a gavel, distinguish between types of motions [main, subsidiary, incidental, privileged, etc.]).

3. Explore the role of the FFA in promoting leadership, personal development, and human relations skills. [DOK1]
   a. Explore the history and nature of the organization in promoting and developing leadership, personal development, and human relations skills.
   b. Identify career-related values and ethics promoted through the organization.
   c. Identify membership benefits.
   d. Select activities that promote personal development and leadership skills.

4. Complete a supervised agricultural experience (SAE) project.

Unit 2: Horticulture Safety

Competencies and Suggested Objectives
1. Demonstrate fundamental safety practices related to horticulture enterprises. DOK1 a. Identify hazards that may be found in horticulture operations, laboratories, and activities (e.g., poisons and other chemicals, sun exposure, ladders and scaffolds, electrical shock [GFI receptacles], fire, poisonous insects and snakes, equipment and tool hazards, spills, slipping, etc.). b. Identify and demonstrate the use of personal protection devices, including eye protection, hearing protection, foot protection, respiratory protection, clothing and body protection, fire extinguishers (Class A, B, and C), eyewash and shower stations, first-aid kits, and other general safety equipment.
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.

Unit 3: Basic Plant Structure and Function

Competencies and Suggested Objectives

1. Explore plant structure and their functions. DOK 2
   a. Draw a diagram of a flowering plant, and label and describe the major parts (roots, stems, leaves, and flowers) and functions as related to plant growth (cell division, cell elongation, and cell differentiation).
   b. Describe the process of respiration, photosynthesis, and transpiration.
   c. Describe the relationship of environmental and cultural factors to plant growth (water, light, temperature, soil, USDA climatic zones).

2. Apply systems of plant classification. DOK1
   a. Examine the taxonomy of plants including history, scientific classification, cultivars, and common nomenclature.
   b. Classify plants according to life cycle, including annual, perennial, deciduous, evergreen, etc.
   c. Interpret the scientific classification of the following shrubs:
      - Littleleaf boxwood / *Buxus microphylla cv.*
      - Common camellia / *Camellia japonica*
      - Common gardenia / *Gardenia jasminoides 'Fortuniana'*
      - Oakleaf hydrangea / *Hydrangea quercifolia*
      - Chinese holly / *Ilex cornuta cv.*
      - Japanese holly / *Ilex crenata cv.*
      - Chinese juniper / *Juniperus chinensis cv.*
      - Creeping juniper / *Juniperus horizontalis cv.*
      - Fountain grass / *Pennisetum ruppelia*
      - Lily-of-the-Valley Bush / *Pieris japonica*
      - Exbury hybrid azalea / *Rhododendron hybrid*
      - Yew / *Taxus spp. and cv*.
      - Chinese wisteria / *Wisteria sinensis cv.*
   d. Interpret the scientific class classification of the following trees:
      - Red maple / *Acer rubrum*
      - Japanese maple / *Acer palmatum cv*.
      - River birch / *Betula nigra*
      - Redbud / *Cercis canadensis*
      - Flowering dogwood / *Cornus florida cv.*
      - Ginkgo, Maidenhair tree / *Ginkgo biloba*
      - Crape myrtle / *Lagerstroemia indica cv.*
      - Sweet gum / *Liquidambar styraciflua*
      - Tulip poplar / *Liriodendron tulipifera*
      - Southern magnolia / *Magnolia grandiflora*
      - Colorado (blue) spruce / *Picea pungens cv.*
      - Japanese black pine / *Pinus thunbergiana*

- Kwanzan Japanese flowering cherry / *Prunus serrulata 'Kwanzan'*
- White oak / *Quercus alba*
- Pin oak / *Quercus palustris*
- Red oak / *Quercus rubra*
- Bald cypress / *Taxodium distichum*

Unit 4: Plant Media

1. Describe and apply principles of plant growth media. DOK2
   a. Identify and compare the components of natural soil (sand, silt, and clay) and soilless mix. List and explain the characteristics each one imparts to the root medium.
   b. Prepare a growing media to specifications or identify the components and proportions in a commercially prepared root medium.
2. Describe the characteristics of an ideal growing medium, including nutrients, water- and air-holding capacity, water drainage, and potential of hydrogen (pH). DOK 1
3. Describe the use of soilless amendments, including vermiculite, perlite, bark, organic matter, and peat moss. DOK 1
4. Identify macronutrients and micronutrients and their effects on plant growth. DOK 2
   a. Describe the effect of excesses and deficiencies of the macronutrients (nitrogen [N], phosphorus [P], potassium [K]).
   b. Predict the effect various pH levels will have on plant nutrition and growth.
   c. Analyze a growing media sample for nutrient deficiencies by using the scientific method.
   d. Calculate fertilizer application rates to meet nutritional requirements for a specific crop.
   e. Select fertilizer application methods for different plant enterprises to include broadcasting, injection systems, incorporating into media, and side dressing.

Unit 5: Horticulture Structures

Competencies and Suggested Objectives
1. Describe the characteristics and features of different types of greenhouses. DOK2 a. Identify and compare the greenhouse structures, coverings, and auxiliary (shade house, hot beds, and cold frame) types: quonset, ridge and furrow, even span, and shade houses. b. Describe environmental controls, including humidistat, thermostat, cooling, watering, and heating. c. Describe the importance of light in plant growth. d. Discuss water, fertigation, and chemigation management in growing plants. e. Identify and describe factors to consider in establishing a floor plan for a greenhouse, including sanitation, benching, flooring, potting facilities, chemical and dry storage, and traffic patterns.

Unit 6: Plant Propagation

Competencies and Suggested Objectives
1. Distinguish between sexual and asexual reproduction. DOK2 a. Describe sexual reproduction in plants. b. Describe the conditions needed for good seed germination. c. Plan and conduct a seed germination test. d. Interpret information found on a seed tag. e. Describe, discuss, or demonstrate how to propagate plants from scarified or stratified seeds. f. Identify and describe asexual reproduction techniques using grafting, budding, cuttings (root, stem and leaf), layering, separation and division, and tissue culture methods. g. Identify common tools, such as hand shears, and chemicals, including hormones, used in asexual reproduction and demonstrate their safe use and care.

Unit 7: Principles of Pest Management

Competencies and Suggested Objectives

1. Assess the effects of pests on plant production. DOK2
   a. Identify the following types of insects and describe how insect affects production, control, and integrated pest management (IPM) practices:
      - Aphid
      - Bagworm
      - Borer
      - Leaf hopper
      - Leaf miner
      - Scale
      - Spider mite
      - Snail/slug
      - Whitefly
      - White grub
   b. Identify the following types of diseases and describe how each disease affects production, control, and IPM practices:
      - Anthracnose
      - Apple scab
      - Black spot
      - Botrytis
      - Canker
      - Cedar-apple rust
      - Crown gall
      - Fire blight
      - Powdery mildew
      - Root rot
   c. Identify the following types of weeds and describe how each weed affects production, control, and IPM practices:
      - Annual bluegrass
      - Broadleaf plantain
      - Buckhorn plantain
      - Chickweed
      - Crabgrass
      - Dandelion
      - Henbit
      - Nutsedge
      - Oxalis
      - Purslane
      - White clover
   d. Identify the following types of physiological problems and describe how each problem affects production, control, and IPM practices:
      - Frost-freeze injury
      - Iron deficiency
      - Leaf scorch (drought/winter burn)
      - Nitrogen deficiency
      - Pot-bound roots
      - String trimmer injury
      - 2, 4-D injury
   e. Design an IPM plan for a designated horticulture crop.
2. Identify, describe, and apply pesticide safety procedures. DOK1
   a. Interpret safety and first aid precautions and formulations on pesticide labels (insecticide, herbicides, rodenticide, fungicide, miticide, molluscicide, and nematicides).
   b. Identify the following beneficial insects and discuss how they benefit plants:
      - Assassin bug
      - Beneficial nematode
      - Big-eyed bug
      - Braconid wasp
      - Mealybug destroyer
      - Praying mantis
      - Predatory stink bugs
      - Soldier beetle

- Green Lacewing
- Lady beetles
- Spider
- Paper wasp

c. Discuss the relationship between biological, chemical, cultural, and mechanical control methods.
d. Discuss and apply general precautions for working with pesticides in relation to the requirements for pesticide applicator's certification/licensure.

Unit 8: Greenhouse Crops and Olericulture Production

Competencies and Suggested Objectives

1. Describe and apply principles of greenhouse crop production. DOK2
   a. Identify and produce various common species of bedding plants, including:
      - Coleus
      - Chrysanthemums
      - Dianthus
      - Geraniums
      - Impatiens
      - Marigold
      - Pansy
      - Petunia
      - Salvia
      - Snapdragon
      - Verbena
      - Vinca
      - Wax begonia
      - Zinnia
   b. Identify and produce various common species of foliage/interior plants, including:
      - African Violet
      - Angelica
      - Cacti
      - Caladiums
      - Dracaena
      - Dumbcane
      - English ivy
      - Ferns (Boston, Kimberly, Macho, Sprengeri)
      - Nephthytis
      - Orchids
      - Peace lily
      - Philodendron
      - Poinsettias
      - Schefflera
      - Snake plant
      - Spider plant
   c. Identify cultural considerations for fertilizer, water, growing medium, pest control, temperature, natural and chemical growth control and stimulation, and light control for common crops.

2. Describe and apply principles of olericulture production. DOK2
   a. Describe characteristics (i.e. cultural requirements, direct seeding versus transplanting, plant growth style, and growing season) of common vegetables grown for commercial production, and distinguish between warm season and cool season crops. Including:
      - Beans
      - Broccoli
      - Brussel sprouts
      - Cabbage
      - Carrots
      - Cauliflower
      - Chives
      - Corn
      - Cucumber
      - Eggplant
      - Garlic
      - Kale
      - Lettuce
      - Okra
      - Onions
      - Peanuts
      - Peas
      - Peppers
      - Potatoes
      - Pumpkin
      - Spinach
      - Squash
      - Tomatoes

b. Identify and demonstrate the use of common tools and equipment used in gardening, including tillers, spreaders, sprayers, watering devices, rakes, hoes, and shovels.
c. Identify and describe factors to consider in preparing a seedbed, including soil class and texture, use of soil amendments, and characteristics of a properly prepared seedbed.
d. Develop a plan for an intensive culture garden including crop and variety selection, location and spacing of different crops, scheduling of crops, crop rotation, and harvesting and marketing of crops.
e. Discuss new and emerging technologies, trends, and issues concerning the production and marketing of vegetables in Mississippi. Identify and discuss the roles of agencies and organizations that regulate the production and marketing of vegetables.

Unit 9: Leadership, Careers, and Safety

Competencies and Suggested Objectives
1. Review program policies, procedures, and safety rules.[DOK2]
2. Practice leadership skills. [DOK2] a. Identify and discuss fundamental parliamentary procedures for participating in a public meeting and for public speaking. b. Select FFA activities that promote personal development and leadership skills.
3. Complete school-to-careers activities related to horticulture. [DOK1] a. Identify employment and career opportunities in the horticulture industry. b. Investigate educational opportunities related to horticulture at the postsecondary level. c. Describe national standards and certification/licensing procedures, trade organizations, associations, and unions as related to horticulture.
4. Complete an SAE. [DOK 3]

Unit 10: Nursery and Landscape Plant Identification

Competencies and Suggested Objectives

1. Review plant materials covered in Unit 3 (see associated list). DOK1
2. Identify and describe the use of major plants associated with nursery and landscape operations. DOK1
   a. Identify and describe the following plants:
      - Adam's Needle (Yucca) / *Yucca filamentosa*
      - Bayberry / *Myrica pensylvanica*
      - Bearded iris / *Iris x germanica florentina* cv.
      - Border forsythia / *Forsythia* × *intermedia* cv.
      - Bumalda spirea / *Spiraea x bumalda*
      - Cherry laurel / *Prunus laurocerasus* cv.
      - Chinese (saucer) magnolia / *Magnolia x soulangiana* cv.
      - Common blanketflower / *Gaillardia aristata* cv.
      - Eastern white pine / *Pinus strobus*
      - Firethorn / *Pyracantha coccinea* cv.
      - Flowering crabapple / *Malus* spp. and cv.
      - Glossy abelia / *Abelia x grandiflora* cv.
      - Heavenly bamboo / *Nandina domestica*
      - Hybrid tea rose / *Rosa* spp.
      - Japanese (flowering) quince / *Chaenomeles speciosa* cv.
      - Lilyturf / *Liriope* spp. cv.
      - London planetree / *Platanus* × *acerifolia*
      - Mentor barberry / *Berberis* × *mentorensis*
      - Oregon grape / *Mahonia aquifolia* cv.
      - Plaintain lily / *Hosta x hybrida* cv.
      - Sour (black) gum / *Nyssa sylvatica*
      - Southern yew / *Podocarpus macrophyllus*
      - Thornless honeylocust / *Gleditsia triacanthos inermis* cv.
      - Washington hawthorn / *Crataegus phaenopyrum*
      - White ash / *Fraxinus americana* cv.
      - Wintercreeper / *Euonymus fortunei* cv.

Unit 11: Horticulture Marketing and Business Procedures

Competencies and Suggested Objectives

1. Describe and apply marketing and business practices associated with horticulture operations. DOK2
   a. Maintain an inventory of plants and supplies for the horticulture program (ongoing throughout the year).
   b. Develop an annual calendar of activities/enterprises for a horticulture business, including ordering materials/supplies for an enterprise.
   c. Describe factors to consider in pricing products of an enterprise and complete a sales transaction that includes providing customer service.
   d. Describe factors to consider in marketing and advertising products.

2. Review basic employee responsibilities and how to communicate effectively in on-the-job situations. DOK3
   a. Describe the following life skills:
      - Communication
      - Considerate
      - Cooperation
      - Dependability
      - Effective listening
      - Empathy
      - Enthusiasm
      - Gets along with others
      - Good manners
      - Honesty
      - Humility
      - Interpersonal skills
      - Loyalty
      - Open-mindedness
      - Positive self-concept
      - Problem-solving
      - Rational thinking
      - Respect for others
      - Responsibility
      - Self-motivated/determined
      - Sets priorities
      - Teamwork
      - Trustworthy
      - Work ethic

3. Discuss and explore business operations. DOK2
   a. Marketing's four Ps (price, product, place, promotion)
   b. Forms of business organizations (sole proprietorship, corporations, partnerships, limited liability companies)
   c. Sources of capital (wholesale versus retail)

Unit 12: Container and Field Crop Production

Competencies and Suggested Objectives

1. Describe and apply principles of container and field crop production. DOK2
   a. Describe advantages and disadvantages of container crop production versus field crop production.
   b. Identify and demonstrate the safe use of tools and equipment for container and field crop production. Include the following:
      - Ball cart (B&B truck)
      - Broadcast (cyclone) spreader
      - Burlap
      - Drip emitter, irrigation
      - Duster
      - Dust mask
      - Fertilizer tablet
      - Grafting tool
      - Granular fertilizer
      - Ground/pelleted limestone
      - Hearing protection
      - Hose-end repair fitting
      - Hose-end sprayer
      - Hose-end washer
      - Hose repair coupling
      - Impact sprinkler
      - Measuring wheel
      - Mist nozzle (mist bed)
      - Nursery container
      - Planting/earth/soil auger
      - Propagation mat
      - PVC (polyvinylchloride) pipe
      - Resin-coated fertilizer
      - Safety goggles
      - Soil sampling tube
      - Solenoid valve
      - Spray suit
      - Tape measure
      - Tree caliper
      - Tree wrap
      - Water breaker
   c. Describe automation and plug production in the nursery industry.
   d. Describe and contrast the different types of nursery irrigation systems.

Unit 13: Landscape Design, Installation, Construction, and Maintenance

Competencies and Suggested Objectives

1. Describe and apply principles of landscape design. DOK2
   a. Describe careers in the landscape design field.
   b. Identify and demonstrate the use of tools and equipment for landscape design, including computer-assisted landscape design hardware and software.
   c. Identify and demonstrate the methods of lettering and symbols used in landscape design plans.
   d. Describe principles of design and design processes associated with landscaping, including simplicity, balance, and proportion.
   e. Prepare a simple landscape plan to scale for a given site, including plant selection and location.

2. Describe and apply basic principles of landscape installation and construction. DOK2
   a. Prepare site analysis/needs assessment for a given site.
   b. Identify and demonstrate the safe use of equipment, materials, and hand tools for landscape maintenance, including:
      - Bark mulch
      - Bow saw
      - Compressed air sprayer
      - Chain saw
      - Edger (power or hand)
      - Edging
      - Erosion netting
      - Garden (spading) fork
      - Garden (bow) rake
      - Garden hoe
      - Gas mask
      - Gravity (drop) spreader
      - Hearing protection
      - Hedge shears
      - Hook-and-blade pruners
      - Landscape fabric
      - Leaf rake
      - Loppers
      - Mattock
      - Pickaxe
      - Pole pruner
      - Polyethylene pipe
      - Pop-up irrigation head
      - Post-hole digger
      - Power blower
      - Power hedge trimmer
      - Pruning saw
      - Reel mower
      - Respirator
      - Rotary mower
      - Rototiller
      - Round point shovel
      - Scoop shovel
      - Shade fabric
      - Sharpening stone
      - Siphon proportioner
      - Soaker hose
      - Spade
      - Square point (flat) shovel
      - String trimmer
      - Trowel
      - T-square
   c. Discuss the essential elements of a landscape installation contract including the warranty and an estimate.
   d. Develop a contract and pricing estimate for the landscape plan.

e. Describe and discuss procedures for preparing a planting site, installing plants, and providing posttransplant care according to a landscape plan. f. Describe licensing requirements for landscape installation. g. Discuss installation and maintenance of a landscape irrigation system.
3. Describe and apply principles of landscape maintenance. DOK2 a. Identify and discuss the proper procedures for pruning trees and shrubs. b. Demonstrate the proper procedure for taking a soil sample. c. Determine and discuss a cost estimate for fertilizer, pest control, and maintenance of trees, shrubs, and beds.

Unit 14: Turfgrass Installation and Maintenance

Competencies and Suggested Objectives

1. Describe and apply principles of turfgrass installation. DOK2
   a. Describe factors to consider in selecting a turfgrass for a specific area. Identify varieties of turfgrass and describe their characteristics. Include the following:
      - Bentgrass
      - Bermuda grass
      - Carpet grass
      - Centipede grass
      - Kentucky bluegrass
      - St. Augustine grass
      - Tall fescue
      - Zoysia

   b. Describe installation practices for different turfgrasses, including site preparation and initial care.

2. Describe and apply principles of turfgrass maintenance. DOK2
   a. Identify and demonstrate the safe use and maintenance of equipment and tools used for turfgrass maintenance, including mower types, dethatchers, aerators, and other equipment.
   b. Use mowers, sprayers, or spreaders for a specific grass.
   c. Identify and describe common turfgrass insects, including:
      - Army worms
      - Chinch bug
      - Japanese beetle
      - Sod webworm
      - White grubs
      - Mole cricket

   d. Identify and describe common turfgrass diseases, including:
      - Brown patch
      - Damping off
      - Dollar spot
      - Fairy ring
      - Grey leaf spot
      - Melting out
      - Pythium blight
      - Rust
      - Slime mold
      - Spring dead spot

   e. Identify and describe common turfgrass weeds, including:
      - Annual Bluegrass
      - Bahia grass
      - Broadleaf Plantain
      - Buckhorn Plantain
      - Common bermuda grass
      - Common chickweed
      - Common purslane
      - Curly dock
      - Cutleaf geranium
      - Dallisgrass
      - Dandelion
      - Goose grass
      - Henbit
      - Large crabgrass
      - Lawn burweed
      - Mouse-ear chickweed
      - Purple nutsedge
      - Smooth crabgrass
      - Smutgrass
      - Virginia buttonweed
      - White clover
      - Wild garlic
      - Wild onion
      - Wood sorrel
      - Yellow foxtail
      - Yellow nutsedge

d. Identify and describe common irrigation methods for turfgrass.
e. Perform cultural practices, including aeration and dethatching.
f. Develop a plan/cost estimate for a turfgrass management program.

Unit 15: Principles of Floristry

Competencies and Suggested Objectives
1. Describe and apply principles of floristry. DOK2 a. Demonstrate the procedures for receiving and storing (including the rotation of inventory) of floral materials. b. Apply basic elements of design with examples that include line, filler, form, and mass. c. Apply basic principles of design to include balance, transition, rhythm, focal point, proportion, and scale to achieve unity. d. Receive and process orders for floral products, including seasonal and event applications. e. Identify and demonstrate the safe and proper use of tools and supplies used in floristry, including shears, tape, foam, floral wire, and knives. Include plant materials (potted, flower, and foliage materials) used in floristry in these demonstrations.

Unit 16: Pomology Production

Competencies and Suggested Objectives

1. Describe and apply principles of fruit and berry production. DOK2
   a. Identify, discuss, and prepare a planting plan, cultural plan and marketing plan of common fruits and berries produced in Mississippi to include the following:
      - Apples
      - Blackberries
      - Blueberries
      - Cantaloupes
      - Figs
      - Melons
      - Muscadines
      - Oranges
      - Peaches
      - Pears
      - Persimmons
      - Plums
      - Pumpkins
      - Raspberries
      - Strawberries
      - Watermelons
   b. Identify, discuss, and describe the local marketing of fruits and vegetables as it relates to state, national, and international organizations that impact fruit and berry production.

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: Horticulture Orientation and Leadership Development		
	1.	Identify school and program policies and procedures related to the horticulture program.
	2.	Develop life and career skills for success in the 21st century.
	3.	Explore the role of the FFA in promoting leadership, personal development, and human relations skills.
	4.	Complete a supervised agricultural experience (SAE) project.
Unit 2: Horticulture Safety		
	1.	Demonstrate basic and fundamental safety practices related to horticulture enterprises.
Unit 3: Basic Plant Structure and Function		
	1.	Explore plant structure and their functions.
	2.	Apply systems of plant classification.
Unit 4: Plant Media		
	1.	Describe and apply principles of plant growth media.
	2.	Describe the characteristics of an ideal growing medium, including nutrients, water- and air-holding capacity, water drainage, and potential of hydrogen (pH).
	3.	Describe the use of soilless amendments, including vermiculite, perlite, bark, organic matter, and peat moss.
	4.	Identify macronutrients and micronutrients and their effects on plant growth.
Unit 5: Horticulture Structures		
	1.	Describe the characteristics and features of different types of greenhouses.
Unit 6: Plant Propagation		
	1.	Distinguish between sexual and asexual reproduction.
Unit 7: Principles of Pest Management		
	1.	Assess the effects of pests on plant production.
	2.	Identify, describe, and apply pesticide safety procedures.

Unit 8: Greenhouse Crops and Olericulture Production		
	1.	Describe and apply principles of greenhouse crop production.
	2.	Describe and apply principles of olericulture production.
Unit 9: Leadership, Careers, and Safety (Ongoing Review and Reinforcement)		
	1.	Review program policies, procedures, and safety rules.
	2.	Practice leadership skills.
	3.	Complete school-to-careers activities related to horticulture.
	4.	Complete an SAE.
Unit 10: Nursery and Landscape Plant Identification		
	1.	Review plant materials covered in Unit 3 (see associated list).
	2.	Identify and describe the use of major plants associated with nursery and landscape operations.
Unit 11: Horticulture Marketing and Business Procedures		
	1.	Describe and apply marketing and business practices associated with horticulture operations.
	2.	Review basic employee responsibilities and how to communicate effectively in on-the-job situations.
	3.	Discuss and explore business operations.
Unit 12: Container and Field Crop Production		
	1.	Describe and apply principles of container and field crop production.
Unit 13: Landscape Design, Installation, Construction, and Maintenance		
	1.	Describe and apply principles of landscape design.
	2.	Describe and apply basic principles of landscape installation and construction.
	3.	Describe and apply principles of landscape maintenance.
Unit 14: Turfgrass Installation and Maintenance		
	1.	Describe and apply principles of turfgrass installation.
	2.	Describe and apply principles of turfgrass maintenance.
Unit 15: Principles of Floristry		
	1.	Describe and apply principles of floristry.
Unit 16: Pomology Production		
	1.	Describe and apply principles of fruit and berry production.

Appendix A: Industry Standards

AFNR National Standards

Crosswalk for Horticulture																	
	Units	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**	**Unit 11**	**Unit 12**	**Unit 13**	**Unit 14**	**Unit 15**	**Unit 16**
ABS.01									X			X		X	X	X	X
ABS.02												X		X	X	X	X
ABS.03												X		X	X	X	X
ABS.04												X		X	X	X	X
ABS.05									X			X		X	X	X	X
ESS.01																	
ESS.02								X	X								X
ESS.03								X	X								
ESS.04			X						X								
ESS.05			X						X					X			X
FPP.01									X								X
FPP.02									X								X
FPP.03									X								X
FPP.04									X								X
NRS.01					X	X			X						X		X
NRS.02									X						X		
NRS.03									X						X		X
NRS.04								X	X						X		X
PS.01				X	X	X	X		X		X		X		X		
PS.02				X	X	X	X		X		X		X		X	X	
PS.03					X	X	X	X	X				X		X	X	
PS.04						X	X		X				X	X	X	X	
PST.01									X							X	
PST.02			X						X					X	X		
PST.03			X						X					X	X		
PST.04						X			X				X	X	X		
PST.05									X					X	X		

Agriculture, Food, and Natural Resources (AFNR) Pathway Content Standards and Performance Elements

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AGRIBUSINESS SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of principles and techniques for the development and management of agribusiness systems.

ABS.01. Apply management planning principles in AFNR businesses.

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

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

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

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

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

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

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

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

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

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

ABS.04. Develop a business plan for an AFNR business.

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

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

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

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

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

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

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

ENVIRONMENTAL SERVICE SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to the management of environmental service systems.

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

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

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

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

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

ESS.03.01. Apply meteorology principles to environmental service systems.
ESS.03.02. Apply soil science and hydrology principles to environmental service systems.
ESS.03.03. Apply chemistry principles to environmental service systems.
ESS.03.04. Apply microbiology principles to environmental service systems.
ESS.03.05. Apply ecology principles to environmental service systems.

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

ESS.04.01. Use pollution control measures to maintain a safe facility environment.
ESS.04.02. Manage safe disposal of all categories of solid waste in environmental service systems.
ESS.04.03. Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations.
ESS.04.04. Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental service systems.

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

ESS.05.01. Use technological and mathematical tools to map land, facilities, and infrastructure for environmental service systems.
ESS.05.02. Perform assessments of environmental conditions using equipment, machinery, and technology.

FOOD PRODUCTS AND PROCESSING SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles, practices, and techniques in the processing, storage, and development of food products.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NATURAL RESOURCE SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to the management of natural resources.

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

NRS.01.01. Apply methods of classification to examine natural resource availability and ecosystem functions in a particular region.

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

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

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

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

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

NRS.02.01. Analyze the interrelationships between natural resources and humans.

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

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

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

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

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

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

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

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

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

NRS.04.01. Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.
NRS.04.02. Diagnose plant and wildlife diseases and follow protocol to prevent their spread.
NRS.04.03. Prevent or manage introduction of ecologically harmful species in a particular region.
NRS.04.04. Manage fires in natural resource systems.

PLANT SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles and techniques to the production and management of plants.

PS.01. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.

PS.01.01. Determine the influence of environmental factors on plant growth.
PS.01.02. Prepare and manage growing media for use in plant systems.
PS.01.03. Develop and implement a fertilization plan for specific plants or crops.

PS.02. Apply principles of classification, plant anatomy, and plant physiology to plant production and management.

PS.02.01. Classify plants according to taxonomic systems.
PS.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.
PS.02.03. Apply knowledge of plant physiology and energy conversion to plant systems.

PS.03. Propagate, culture, and harvest plants and plant products based on current industry standards.

PS.03.01 Demonstrate plant propagation techniques in plant system activities.
PS.03.02. Develop and implement a management plan for plant production.
PS.03.03. Develop and implement a plan for integrated pest management for plant production.
PS.03.04. Apply principles and practices of sustainable agriculture to plant production.
PS.03.05 Harvest, handle, and store crops according to current industry standards.

PS.04. Apply principles of design in plant systems to enhance an environment (e.g., floral, forest landscape, and farm).

PS.04.01. Evaluating, identifying, and preparing plants to enhance an environment.

POWER, STRUCTURAL AND TECHNICAL SYSTEMS

Pathway Content Standard: The student will demonstrate competence in the application of principles and techniques for the development and management of power, structural, and technical systems.

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

PST.01.01. Apply physical science laws and engineering principles to assess and select energy sources for AFNR power, structural and technical systems.
PST.01.02. Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.
PST.01.03. Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).

PST.02. Operate and maintain AFNR mechanical equipment and power systems.
PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.
PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

PST.03. Service and repair AFNR mechanical equipment and power systems.
PST.03.01. Troubleshoot, service, and repair components of internal combustion engines using manufacturers' guidelines.
PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.
PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment, and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).

PST.04. Plan, build and maintain AFNR structures.
PST.04.01. Create sketches and plans for AFNR structures.
PST.04.02. Determine structural requirements, specifications and estimate costs for AFNR structures.
PST.04.03. Follow architectural and mechanical plans to construct and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).
PST.04.04. Apply electrical wiring principles in AFNR structures.

PST.05. Use control, monitoring, geospatial, and other technologies in AFNR power structural and technical systems.
PST.05.01. Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.
PST.05.02. Prepare and/or use electrical drawings to design, install, and troubleshoot electronic control systems in AFNR settings.
PST.05.03. Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems.