AGRISCIENCE TECHNOLOGY III

#01023

Description

Agriscience Technology courses integrate biological and technological concepts with principles of agriculture. Courses are designed in sequences to provide experiences in the subject matter. Units are selected to develop knowledge and skills pertaining to nutrition, reproduction, diseases, breeding, genetics, anatomy, and physiology in animals and plants. Genetic engineering, biotechnology, plant propagation techniques, agricultural production technologies, marketing technologies, aquaculture, animal health, and small animal care are examples of units that may be taught.

These courses integrate leadership and supervised agricultural experience programs. Career opportunities and educational preparation are examined. Learning activities are varied with classroom, laboratory and field experiences.

Note: These courses can be taught for Agricultural Education credit only.

½ to 1 credit
Max credit=1
Grades 9-12

Standard 1	***AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) FOUNDATIONAL PATHWAY SKILLS***	
Topic 1.1	**Research, examine, and discuss issues and trends that impact AFNR systems on local, state, national, and global levels.**	
	Student Competencies	
	1.1.5	Interpret AFNR issues and their impacts to audiences with limited AFNR knowledge.
	1.1.6	Determine the opportunities emerging trends create within the AFNR systems.
Topic 1.2	**Examine technologies and analyze their impact on AFNR systems.**	
	Student Competencies	
	1.2.5	Develop solutions in AFNR workplaces or scenarios using technology.
	1.2.6	Evaluate the importance of technology use and how it impacts AFNR systems.
Topic 1.4	**Research and use geographic and economic data to solve problems in AFNR systems.**	
	Student Competencies	
	1.4.5	Defend the use of a set of geographical data used to solve a problem within AFNR systems.
	1.4.6	Create a strategy to solve a problem in an AFNR system using a set of economic data.
Topic 1.5	**Examine the impact of AFNR on the local, state, national, and global society and economy.**	
	Student Competencies	
	1.5.7	Develop a strategy for explaining the breadth of AFNR systems to audiences with limited AFNR knowledge.
	1.5.8	Evaluate how cultural traditions, customs or policies have resulted from practices with AFNR systems.
	1.5.9	Evaluate how positive or negative changes in the local, state, national or global economy impacts AFNR systems.
Topic 1.6	**Identify and explain the implications of required regulations to maintain and improve safety, health, and environmental management systems.**	
	Student Competencies	
	1.6.5	Evaluate how AFNR organizations and businesses promote improved health, safety, and environmental management.
	1.6.6	Develop methods to evaluate compliance with required safety, health, and environmental management regulations.
Topic 1.7	**Develop and implement a plan to maintain and improve health, safety, and environmental compliance and performance.**	
	Student Competencies	
	1.7.5	Create and implement a plan to improve safety, health, and environmental management regulations in an AFNR workplace.
	1.7.6	Develop a strategy to educate employees on environmental compliance and performance in an AFNR workplace.
Topic 1.8	**Apply health and safety practices to AFNR workplaces.**	
	Student Competencies	

	1.8.7	Create a plan to communicate appropriate responses for health and safety situations within an AFNR workplace.
	1.8.8	Evaluate AFNR workplaces to identify structure of health and safety practices and number of employees certified in first aid training.
	1.8.9	Create a plan to mitigate the level of contamination or injury identified as a risk in the workplace.
Topic 1.9	**Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.**	
	Student Competencies	
	1.9.7	Design plans to ensure the use of appropriate protective equipment when using various AFNR tools and equipment.
	1.9.8	Choose appropriate tools and equipment to complete AFNR tasks.
	1.9.9	Design operation, storage, and maintenance plans or schedules for AFNR tools and equipment.
Topic 1.10	**Identify and implement practices to steward natural resources in different AFNR systems.**	
	Student Competencies	
	1.10.5	Create strategies for stewarding natural resources at home and within community.
	1.10.6	Recommend sustainability policies and plans for potential improvements for AFNR businesses or organizations.
Topic 1.11	**Assess and explain the natural resource related trends, technologies, and policies that impact AFNR systems.**	
	Student Competencies	
	1.11.5	Predict emerging natural resource trends and technologies within AFNR systems.
	1.11.6	Propose strategies for implementing a new natural resources policy to positively impact AFNR systems.
Topic 1.12	**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.).**	
	Student Competencies	
	1.12.7	Assess personal AFNR career goal progress.
	1.12.8	Design a personal plan for attaining the required education, training, and experiences for a career in an AFNR pathway.
	1.12.9	Justify personal goals, experiences, education, and skills to pursue a career in an AFNR pathway.
Topic 1.13	**Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest.**	
	Student Competencies	
	1.13.3	Evaluate the results of a personal career assessment related to potential careers in AFNR pathways.
Topic 1.14	**Examine and explain foundational cycles and systems of AFNR.**	
	Student Competencies	
	1.14.5	Interpret the impact of life cycles within AFNR systems.
	1.14.6	Predict how AFNR systems may change or adapt in the future of food, feed, fiber, and fuel production based on current trends and data.
Topic 1.15	**Recognize the value of a Supervised Agricultural Experience (SAE) as Work-Based Learning.**	
	Student Competencies	
	1.15.7	Justify the value of SAEs to students and their future.
	1.15.8	Evaluate the types of lifelong learning and career skills that SAEs help to develop.

	1.15.9	Compare the components of foundational and immersion SAEs.
Topic 1.16	**Implement the components of a Foundational SAE.**	
	Student Competencies	
	1.16.11	Implement and adjust a career plan of study.
	1.16.12	Practice employability skills that are important in a chosen career field.
	1.16.13	Apply personal financial practices that lead to financial independence.
	1.16.14	Design a workplace safety plan for a foundational SAE.
	1.16.15	Apply knowledge of issues, trends, technologies, and public policies that impact AFNR systems to solve a problem.
Topic 1.17	**Recognize the options within and participate in immersive supervised agricultural experiences.**	
	Student Competencies	
	1.17.5	Practice the skills required to be successful in a specific AFNR career field through an immersion SAE experience.
	1.17.6	Implement record-keeping practice for a specific immersion SAE.
Topic 1.19	**Evaluate the structure and value of agricultural education.**	
	Student Competencies	
	1.19.9	Develop a plan to teach someone else about the 3-circle Ag. Education model.
	1.19.10	Justify the need for classroom instruction within agricultural education.
	1.19.11	Justify the need for FFA within agricultural education.
	1.19.12	Justify the need for SAE within agricultural education.
Topic 1.22	**Evaluate opportunities to develop leadership, citizenship, and career skills.**	
	Student Competencies	
	1.22.9	Evaluate your personal leadership skills and areas of growth related to leadership.
	1.22.10	Evaluate your personal citizenship and areas of growth.
	1.22.11	Evaluate your personal career skills and areas of growth.
	1.22.12	Design a plan to develop your personal leadership skills, including citizenship and career skills.

Standard 3	*ANIMAL SYSTEMS*	
Topic 3.1	**Evaluate the development and implications of animal origin, domestication, and distribution on production practices and the environment.**	
	Student Competencies	
	3.1.5	Evaluate the implications of animal characteristics on production practices and the environment.
	3.1.6	Evaluate trends (e.g., labor, economic, environmental, etc.) and implications of future developments within different animal industries on production practices and the environment.
Topic 3.2	**Assess and select animal production, marketing, and management methods based upon effectiveness and potential social and environmental impacts.**	
	Student Competencies	
	3.2.9	Evaluate the effectiveness of different production, marketing, and management methods using data and evidence.
	3.2.10	Develop marketing plans for an animal agriculture product or service.
	3.2.11	Appraise the use of a specific record management system based upon its effectiveness for a business related to animal systems.
	3.2.12	Design plans to manage wildlife populations to achieve a balance of optimal ecological health and animal production.
Topic 3.3	**Analyze laws and sustainable practices that impact animal agriculture from a local, tribal, state, national, and global perspective.**	
	Student Competencies	
	3.3.5	Evaluate the impact of laws pertaining to animal agriculture (e.g., pros, cons, effect on individuals, effect on businesses, etc.).
	3.3.6	Create a plan for sustainable practices in animal agriculture.
Topic 3.4	**Explain management techniques that ensure animal welfare.**	
	Student Competencies	
	3.4.5	Design quality-assurance programs and procedures for animal production.
	3.4.6	Design safety procedures and plans for working with different species of animals based on animal behaviors and economical impact.
Topic 3.5	**Analyze procedures to ensure that animal products are safe for consumption.**	
	Student Competencies	
	3.5.7	Recommend the use of specific techniques used to perform animal husbandry and welfare procedures.
	3.5.8	Evaluate programs to ensure the safety of animal products for consumption.
	3.5.9	Evaluate the effectiveness of animal tracking systems for a given species.
Topic 3.6	**Analyze the nutritional needs of animals.**	
	Student Competencies	
	3.6.3	Develop a nutritionally balanced ration for an animal based on its production stage.
Topic 3.7	**Analyze feed rations and assess if they meet the nutritional needs of animals.**	

Student Competencies		
	3.7.5	Select appropriate feedstuffs for animals based on a variety of factors (e.g., economics, digestive system, and nutritional needs, etc.).
	3.7.6	Recommend whether or not to use feed additives and growth promotants using scientific evidence, production system needs, goals, and industry standards.
Topic 3.8	**Utilize tools, equipment, techniques, and technology to make animal nutrition decisions.**	
Student Competencies		
	3.8.5	Evaluate the use of specific tools, equipment, techniques, and technology used to perform animal nutrition tasks.
	3.8.6	Evaluate the potential impacts, positive and negative, of compliance and/or noncompliance with a feed label and feeding directions.
Topic 3.9	**Evaluate animals for breeding readiness and soundness.**	
Student Competencies		
	3.9.7	Select breeding animals based on the health of the reproductive organs (e.g., reproductive soundness exams, etc.).
	3.9.8	Evaluate animals for reproductive readiness.
	3.9.9	Defend decisions to treat or cull animals with reproductive problems with both welfare and economic factors.
Topic 3.10	**Apply scientific principles to select and care for breeding animals.**	
Student Competencies		
	3.10.9	Evaluate breeding systems based on the principles of genetics.
	3.10.10	Justify the selection of breeding pairs to achieve a desired outcome.
	3.10.11	Recommend breeding decisions using DNA analysis data.
	3.10.12	Create a plan to differentiate care of a species of breeding animals throughout their reproductive stages.
Topic 3.11	**Apply scientific principles to animal breeding.**	
Student Competencies		
	3.11.9	Select animal breeding methods based on reproductive and economic efficiency.
	3.11.10	Evaluate the implementation and effectiveness of artificial insemination techniques.
	3.11.11	Create a breeding plan that outlines procedures for estrous synchronization, superovulation, flushing, embryo transfer, and other reproductive management practices given a scenario.
	3.11.12	Evaluate animals for theoretical purchase based on Expected Progeny Difference, performance records, pedigrees, and specified production scenarios.
Topic 3.12	**Design and evaluate animal housing, equipment, and handling facilities for the major systems of animal production.**	
Student Competencies		
	3.12.5	Design an animal facility focusing on animal requirements, economic efficiency, sustainability, safety, and ease of handling.
	3.12.6	Recommend enhancements to equipment, technology, and handling procedures to improve sustainability and production efficiency.
Topic 3.13	**Comply with government regulations and safety standards for facilities used in animal production.**	
Student Competencies		

	3.13.5	Create facility designs to ensure they meet standards for the legal, safe, ethical, economical, and efficient production of animals.
	3.13.6	Evaluate the impact of laws pertaining to animal systems.
Topic 3.14	**Classify animals according to taxonomic classification systems and use (e.g., agricultural, companion, etc.).**	
	Student Competencies	
	3.14.7	Evaluate taxonomic characteristics to arrange animals according to the taxonomic classification system.
	3.14.8	Recommend different uses for an animal species based upon an analysis of local market needs, economic circumstances, and environmental circumstances.
	3.14.9	Communicate knowledge of animal systems with proper classification terms to others in an effective and accurate manner.
Topic 3.15	**Apply principles of comparative anatomy and physiology to uses within various animal systems.**	
	Student Competencies	
	3.15.7	Correlate the functions of animal cell structures to animal growth, development, health, and reproduction.
	3.15.8	Investigate how the processes of meiosis and mitosis can solve animal growth, development, health, and reproductive problems.
	3.15.9	Apply knowledge of anatomical and physiological characteristics of animals to make production and management decisions.
Topic 3.16	**Select animals for specific purposes and maximum performance based on anatomy and physiology.**	
	Student Competencies	
	3.16.5	Select animals to maximize performance based on anatomical and physiological characteristics. that affect health, growth, and reproduction.
	3.16.6	Evaluate animals to produce superior animal products based on industry standards.
Topic 3.17	**Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.**	
	Student Competencies	
	3.17.11	Select tools, techniques, and technology to meet specific animal health management goals.
	3.17.12	Determine when an animal health concern needs to be referred to an animal health professional.
	3.17.13	Treat common diseases, parasites, and physiological disorders of animals according to directions prescribed by an animal health professional.
	3.17.14	Design a health maintenance and a disease and disorder prevention plan for animals in their natural and/or confined environments.
	3.17.15	Recommend surgical and nonsurgical veterinary treatments and procedures to meet specific animal health care objectives.
Topic 3.18	**Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.**	
	Student Competencies	
	3.18.5	Design a biosecurity plan for an animal operation.

	3.18.6	Evaluate the effectiveness of zoonotic disease prevention methods and procedures to identify those that are best suited to ensure public safety and animal welfare.
Topic 3.19	**Design management practices related to animal agriculture to enhance the environment.**	
	Student Competencies	
	3.19.3	Devise a plan that includes measures to reduce the negative impact and maximize the positive impact of animal agriculture on the environment.
Topic 3.20	**Evaluate the effects of environmental conditions on animals.**	
	Student Competencies	
	3.20.5	Apply valid and reliable research evidence to predict the potential effects of different environmental conditions for an animal population.
	3.20.6	Develop plans to establish favorable environmental conditions for animal growth, performance, welfare, and health based on a variety of factors (e.g., economic feasibility, environmental sustainability, impact on animals, etc.).

Standard 4	*BIOTECHNOLOGY SYSTEMS*	
Topic 4.1	**Investigate and explain the relationships in the timeline of developing biotechnology applications and techniques in agriculture (e.g., major innovators, historical developments, potential applications of biotechnology, etc.).**	
	Student Competencies	
	4.1.7	Design a potential application of biotechnology to meet emerging agricultural and societal needs.
	4.1.8	Evaluate the short-term and long-term benefits and risks of applying biotechnology to agriculture.
	4.1.9	Create an individualized student experience that applies basic lab skills to lead to one of the identified jobs and careers.
Topic 4.2	**Evaluate the roles, scope, and implications of regulatory agencies on applications of biotechnology in agriculture and the protection of public interests (e.g., health, safety, environmental issues, etc.).**	
	Student Competencies	
	4.2.7	Evaluate how countries with different biotechnology regulatory systems impact trade and innovation.
	4.2.8	Propose a plan to address a regulatory issue pertaining to biotechnology in agriculture.
	4.2.9	Evaluate if new technologies present regulatory issues to health, safety or the environment.
Topic 4.3	**Analyze the relationship and implications of bioethics, laws, and public perceptions on applications of biotechnology in agriculture (e.g., ethical, legal, social, cultural issues).**	
	Student Competencies	
	4.3.7	Devise an argument for or against an ethical issue associated with biotechnology in agriculture.
	4.3.8	Propose a solution for a legal issue associated with biotechnology in agriculture.
	4.3.9	Design a survey to examine public perceptions of scientifically-based arguments regarding biotechnology in agriculture and reflect on the reasons why the public may support or resist significant breakthroughs using biotechnology.
Topic 4.4	**Read, document, evaluate, and secure accurate laboratory records of experimental protocols, observations, and results.**	
	Student Competencies	
	4.4.7	Propose improvements to documentation to ensure study replication, utility, and safety.
	4.4.8	Devise a strategy for ensuring the security of data and information collected in a laboratory.
	4.4.9	Create an application of bioinformatics to solve an agricultural issue.
Topic 4.5	**Identify and apply standard laboratory procedures and equipment maintenance to create and maintain reliable data.**	
	Student Competencies	
	4.5.7	Develop a maintenance program for laboratory equipment based upon the standard operating procedures.
	4.5.8	Develop a proposal for new laboratory equipment or measurement devices.
	4.5.9	Create a plan for sterilizing equipment in a laboratory according to standard operating procedures.
Topic 4.6	**Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.**	
	Student Competencies	
	4.6.7	Evaluate the benefits and limitations of personal protective equipment.
	4.6.8	Create a standard operating procedure for working with biological materials based upon their classification.

	4.6.9	Create a plan for the storage of solutions (e.g., temperature, volatility, neighboring solutions, light sensitivity, etc.).
Topic 4.7	**Safely manage and dispose of biological materials, chemicals, and wastes according to standard operating procedures.**	
	Student Competencies	
	4.7.3	Propose a management plan to reduce laboratory waste and prevent ecological or health problems related to waste disposal.
Topic 4.8	**Examine and perform scientific procedures using microbes, DNA, RNA and proteins in a laboratory.**	
	Student Competencies	
	4.8.9	Create protocols to isolate, maintain, quantify, and store cell cultures according to standard operating procedures.
	4.8.10	Interpret data generated by extracting and purifying DNA or RNA (e.g., southern blotting, cloning, PCR, RT-PCR, etc.).
	4.8.11	Evaluate the biochemical properties of proteins to predict potential uses.
	4.8.12	Detect and quantify antigens by conducting an Enzyme-Linked Immunosorbent Assay (ELISA).
Topic 4.9	**Apply biotechnology principles, techniques, and processes to modify a species.**	
	Student Competencies	
	4.9.5	Design experiments to evaluate an existing transgenic organism.
	4.9.6	Evaluate the results of a cellular transformation.
Topic 4.10	**Apply biotechnology principles, techniques, and processes to enhance the production of food through the use of microorganisms and enzymes.**	
	Student Competencies	
	4.10.7	Design an assay to detect a target microorganism in food, water, or the environment.
	4.10.8	Conduct studies using scientific techniques to improve or discover enzymes for use in biotechnology (e.g., microbial strain selection).
	4.10.9	Process food using biotechnology to achieve an intended purpose (e.g., preservation, flavor enhancement, etc.).
Topic 4.11	**Apply biotechnology principles, techniques, and processes to protect the environment and maximize use of natural resources (e.g., biomass, bioprospecting, industrial biotechnology, etc.).**	
	Student Competencies	
	4.11.7	Evaluate the impact of modified organisms on the natural environment.
	4.11.8	Evaluate processes used in the synthesis of a molecule.
	4.11.9	Propose opportunities to use bioprospecting after weighing the short-term and long-term impacts on the environment.
Topic 4.12	**Apply biotechnology principles, techniques, and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).**	
	Student Competencies	
	4.12.9	Perform plant-breeding techniques (e.g., plant tissue culture, etc.).
	4.12.10	Design animal-care protocols to ethically monitor and promote animal systems associated with biotechnology.
	4.12.11	Evaluate the process used to produce pharmaceuticals from transgenic organisms (e.g., hormones for animals, etc.).
	4.12.12	Evaluate whether current threats to biodiversity will have an unsustainable impact on human populations.

Topic 4.13	**Apply biotechnology principles, techniques, and processes to produce bioproducts (e.g., fermentation, transesterification, methanogenesis, etc.).**	
	Student Competencies	
	4.13.11	Defend how bioproducts could solve a global issue (e.g., environmental, agricultural, etc.).
	4.13.12	Evaluate the pros and cons of the technologies used to create bioproducts from biomass.
	4.13.13	Produce alcohol and co-products from biomass.
	4.13.14	Produce biodiesel and co-products from biomass.
	4.13.15	Produce methane and co-products from biomass.
Topic 4.14	**Apply biotechnology principles, techniques, and processes to improve waste management (e.g., genetically modified organisms, bioremediation, etc.).**	
	Student Competencies	
	4.14.9	Conduct studies to evaluate the treatment of a waste product using a genetically engineered organism.
	4.14.10	Evaluate the treatment of biological wastes with microorganisms.
	4.14.11	Monitor the treatment of industrial chemical wastes with microorganisms.
	4.14.12	Design a bioremediation project including plans to evaluate the effectiveness of the effort.

Standard 5		***EDUCATION, COMMUNICATION, AND LEADERSHIP***
Topic 5.1	**Explore the breadth of opportunities in agricultural education (e.g., using state or national resources, Teach Ag, university program information, professional associations, etc.).**	
	Student Competencies	
	5.1.3	Conduct a self-assessment to determine potential agricultural education career paths.
Topic 5.2	**Apply fundamental understanding of AFNR and agricultural education - including experiential learning - to the development of a workshop or lesson.**	
	Student Competencies	
	5.2.3	Justify the need for an agricultural education program based on a specific demographic need (e.g., school or community issue or priority, etc.).
Topic 5.3	**Develop and deliver a workshop or lesson using a variety of methods and best practices in instruction and facilitation.**	
	Student Competencies	
	5.3.3	Create formative and summative assessments for a program, workshop, or lesson.
Topic 5.4	**Evaluate facilitation or presentation strategies that encourage appropriate social interactions, embrace diversity, promote equity and build a positive learning environment that is welcoming to all individuals.**	
	Student Competencies	
	5.4.3	Select methods of instruction and modalities that accommodate various learner styles and abilities, including personal and cultural assets.
Topic 5.5	**Demonstrate impactful leadership as a credible resource for AFNR.**	
	Student Competencies	
	5.5.3	Create facilitation strategies to engage peers in reaching team and organizational goals in a variety of environments.
Topic 5.6	**Identify the methods and characteristics of effective verbal, nonverbal, written, and visual communication.**	
	Student Competencies	
	5.6.5	Evaluate the benefits of using different communication methods in AFNR.
	5.6.6	Create a communication plan for addressing questions, situations, and criticism of issues within AFNR.
Topic 5.7	**Analyze the use of verbal, nonverbal, written, and visual communication platforms in AFNR.**	
	Student Competencies	
	5.7.5	Design different forms of written and visual communication to achieve a communication strategy.
	5.7.6	Investigate the misuse and potential impact of digital communication tools (e.g., misinformation, plagiarism, generative AI, misuse of photos, copyright, etc.).
Topic 5.8	**Analyze similarities and differences between verbal, nonverbal, written, and visual communication methods.**	
	Student Competencies	

	5.8.7	Demonstrate elements of the writing process - including planning, organizing, writing, and editing/revising - to create a news release, or professional email, social media post, media plan, etc.
	5.8.8	Demonstrate the fundamentals of photography, editing, layout, graphic images, and/or design to create a visual message.
	5.8.9	Demonstrate verbal communication tactics such as active listening, interviewing, and/or public speaking to create a message.
Topic 5.9	**Develop a communications plan that includes purpose, target audience, message, medium, and outcome evaluation.**	
	Student Competencies	
	5.9.3	Propose communication method(s) for effectively reaching target audience(s) and methods for measuring desired outcomes (e.g. verbal/written feedback, survey, poll, etc.).
Topic 5.10	**Identify, apply and demonstrate communication skills and methods per the communications plan.**	
	Student Competencies	
	5.10.7	Critique various written communication methods used in AFNR (e.g., news release, blog, social media post, email communication, etc.).
	5.10.8	Critique various visual communication methods used in AFNR.
	5.10.9	Critique various verbal communication methods used in AFNR.
Topic 5.11	**Identify characteristics and behaviors that constitute ethical, efficient, and effective leadership.**	
	Student Competencies	
	5.11.3	Conduct a self-assessment of personal ethical and effective leadership characteristics and reflect upon the results to identify strengths and opportunities for growth improvement in the workplace (e.g., time management, planning, prioritizing, etc.).
Topic 5.12	**Demonstrate leadership through advocacy for AFNR-related issues.**	
	Student Competencies	
	5.12.3	Create a personal leadership development plan to fully develop or improve one or more characteristics of an effective leader.

Standard 6	***ENVIRONMENTAL SYSTEMS***	
Topic 6.1	**Analyze and interpret laboratory and field samples in environmental sustainability systems.**	
	Student Competencies	
	6.1.5	Prepare sample measurements using appropriate data collection techniques.
	6.1.6	Utilize data analysis to identify trends in a data sample and assess the confidence that can be drawn from those conclusions.
Topic 6.2	**Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).**	
	Student Competencies	
	6.2.5	Calibrate and use laboratory equipment according to standard operating procedures.
	6.2.6	Calibrate and use environmental monitoring instruments according to standard operating procedures.
Topic 6.3	**Interpret and evaluate the impact of laws, agencies, policies, practices, and consumer preferences affecting environmental service systems.**	
	Student Competencies	
	6.3.9	Evaluate the impact of laws associated with environmental sustainability systems (e.g., wildlife, people, environment, economy, etc.).
	6.3.10	Evaluate the impact of government agencies (e.g., local, state, and federal) associated with environmental sustainability systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.).
	6.3.11	Evaluate the impact of Non Government Organizations (e.g., local, state, and federal) associated with environmental sustainability systems.
	6.3.12	Evaluate the impact of policies, practices, and initiatives common in business and advocacy groups associated with environmental sustainability systems on wildlife, people, the environment, and the economy.
Topic 6.4	**Compare and contrast the impact of current trends on regulation of environmental sustainability systems.**	
	Student Competencies	
	6.4.9	Devise a plan for educating others about greenhouse gas emissions and the impact on the supply chain.
	6.4.10	Evaluate the impact of specific environmental sustainability regulation policies (e.g., Clean Air Act, EISA, Clean Water Act, Superfund, etc.) on international trade.
	6.4.11	Predict the impact of future population growth on the regulation of environmental sustainability systems.
	6.4.12	Develop an action plan to address a current policy or topic to advance the region's environmental sustainability systems.
Topic 6.5	**Examine and summarize the impact of public perceptions and social movements on the regulation of environmental sustainability systems.**	
	Student Competencies	
	6.5.5	Evaluate the impact of specific historical figures, or organizations, on the perception and regulation of environmental sustainability systems.

	6.5.6	Devise strategies for engaging the public to address a current AFNR issue brought on by social change.
Topic 6.6	**Apply meteorology principles to environmental sustainability systems.**	
	Student Competencies	
	6.6.9	Evaluate the impact of atmospheric conditions on environmental sustainability systems using meteorological data.
	6.6.10	Interpret data measuring air pollution, its threat on human populations, and ecological interactions.
	6.6.11	Evaluate the potential impacts of global climate change on environmental sustainability systems.
	6.6.12	Create an action plan to mitigate the impact of climate change on environmental sustainability systems.
Topic 6.7	**Apply soil science and hydrology principles to environmental sustainability systems.**	
	Student Competencies	
	6.7.13	Design a master land-use management plan for a given area that utilizes land capability classes to minimize erosion and flooding, maximize development, and preserve topsoil.
	6.7.14	Evaluate the soil composition to determine changes needed in the environmental sustainability system.
	6.7.15	Evaluate different types of soil to determine their potential for filtration of groundwater supplies and likelihood for flooding.
	6.7.16	Evaluate the methods used in a given example to protect groundwater.
	6.7.17	Develop a plan to address water resources based on availability and human activity.
	6.7.18	Recommend strategies for wetlands preservation and restoration that maximize services provided by wetlands while taking human concerns into consideration.
Topic 6.8	**Apply chemistry principles to environmental sustainability systems.**	
	Student Competencies	
	6.8.9	Determine how a sample's soil chemistry may impact considerations in environmental sustainability systems.
	6.8.10	Determine how a sample's water chemistry may impact considerations in environmental sustainability systems.
	6.8.11	Assess the impact of atmospheric chemistry on operational decisions in environmental sustainability systems.
	6.8.12	Evaluate the services provided by different types of wetlands.
Topic 6.9	**Apply microbiology principles to environmental sustainability systems.**	
	Student Competencies	
	6.9.9	Evaluate how soil microorganisms in environmental sustainability systems can be used to minimize waste, maximize nutrient cycling, and increase ecosystem biodiversity.
	6.9.10	Develop strategies for negating air pollutants based on soil microbial populations (e.g., carbon sequestration and rates of decomposition).
	6.9.11	Recommend strategies to further reduce the environmental, economic, and social impact of wastewater treatment.
	6.9.12	Interpret the results of bioassay tests related to environmental sustainability systems.
Topic 6.10	**Apply ecology principles to environmental sustainability systems.**	
	Student Competencies	
	6.10.9	Predict how changing the levels of biodiversity of an area will impact environmental sustainability systems.
	6.10.10	Devise strategies to minimize the future loss of habitats in environmental sustainability systems.

	6.10.11	Devise a strategy for monitoring and supporting environmental sustainability systems through management of a species' carrying capacity.
	6.10.12	Determine the pollutants in a given area using evidence from bioindicator species.
Topic 6.11	**Develop systems of sustainability management for all categories of solid waste in environmental sustainability systems.**	
	Student Competencies	
	6.11.7	Evaluate evidence for a given area for industrial and nonindustrial pollution.
	6.11.8	Create a plan for pollution remediation, management, or prevention for a given area.
	6.11.9	Construct a plan for handling hazardous waste in the local environment.
Topic 6.12	**Sustainably manage solid waste in environmental service systems.**	
	Student Competencies	
	6.12.9	Develop a plan for solid waste management for a given situation that considers the environmental hazards, economic realities, and social concerns associated with this task.
	6.12.10	Evaluate sanitary landfill procedures for environmental, economic, and social sustainability.
	6.12.11	Evaluate the appropriateness of composting methods in different situations.
	6.12.12	Evaluate recycling programs and procedures.
Topic 6.13	**Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations.**	
	Student Competencies	
	6.13.5	Evaluate samples of water and the processes necessary to verify that the samples are safe for consumption according to applicable standards.
	6.13.6	Evaluate examples of wastewater and/or septic waste for its potential to cause environmental, economic, and/or social problems.
Topic 6.14	**Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental sustainability systems.**	
	Student Competencies	
	6.14.11	Evaluate the impact burning fossil fuels has on environmental sustainability systems.
	6.14.12	Evaluate the impact alternative energy sources have on environmental conditions.
	6.14.13	Determine the most effective course of action to reduce energy consumption based on the needs of environmental sustainability systems.
	6.14.14	Recommend a method to reduce the imbalance in the carbon cycle through changes to energy consumption using data from environmental monitoring.
	6.14.15	Determine the best option for energy in regard to environmental sustainability systems using data from a life cycle assessment.
Topic 6.15	**Use technological and mathematical tools to map land, facilities, and infrastructure for environmental sustainability systems.**	
	Student Competencies	

	6.15.5	Make a recommendation to address concerns and needs within an environmental sustainability systems situation using site measurements.
	6.15.6	Interpret GIS data to come to a conclusion about a scenario specific to environmental sustainability systems.
Topic 6.16	**Perform assessments of environmental conditions using equipment, machinery, and technology.**	
	Student Competencies	
	6.16.9	Evaluate a sample of water to determine its quality and if it has been contaminated.
	6.16.10	Evaluate a sample of soil to determine its quality and if it has been contaminated.
	6.16.11	Perform an evaluation of air quality to determine and assess its impact on human and ecological populations.
	6.16.12	Evaluate a habitat to determine its ecological quality and if it is threatened.

Standard 7	***FOOD PRODUCTS AND PROCESSING SYSTEMS***	
Topic 7.1	**Distinguish between various food safety programs and management systems in food products and processing facilities.**	
	Student Competencies	
	7.1.5	Construct plans that ensure implementation of safety programs for food products and processing facilities.
	7.1.6	Construct food product protocols and parameters (Standard Operating Procedures) based upon equipment used in food products and processing.
Topic 7.2	**Apply food safety and quality assurance procedures in the harvesting, handling, and processing of food products.**	
	Student Competencies	
	7.2.11	Evaluate the effectiveness of a control method implemented.
	7.2.12	Evaluate the effectiveness of a cross-contamination control method implemented (e.g., allergen swabbing).
	7.2.13	Interpret outcomes from safe handling procedures and results from quality assurance tests.
	7.2.14	Evaluate results of quality assurance tests on food products and examine steps to implement corrective procedures.
	7.2.15	Interpret microbiological tests for food-borne pathogens.
Topic 7.3	**Apply food safety procedures during storage and distribution to ensure food quality.**	
	Student Competencies	
	7.3.5	Prepare plans that ensure implementation of proper food storage procedures.
	7.3.6	Recommend improvements to a documentation procedure used within a food products and processing facility.
Topic 7.4	**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.**	
	Student Competencies	
	7.4.5	Analyze the properties of food products to identify food constituents and evaluate nutritional value.
	7.4.6	Construct methods to design a healthy daily food guide for a variety of nutritional needs.
Topic 7.5	**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.**	
	Student Competencies	
	7.5.7	Design experiments to determine the chemical and physical properties of food products.
	7.5.8	Devise strategies to determine what additives are utilized and why they are included in a variety of food products.
	7.5.9	Develop plans to engineer new food items using bio-chemistry concepts.
Topic 7.6	**Apply principles of human behavior to develop food products to provide a safe, wholesome, and nutritious food supply for local and global food systems.**	
	Student Competencies	
	7.6.5	Determine a strategy to prepare and label foods according to the established standards of regulatory agencies.
	7.6.6	Design new food products that meet a variety of objectives (e.g., consumer preferences, market, nutritional needs, regulatory requirements, etc.).

Topic 7.7	**Implement selection, evaluation, and inspection techniques to ensure safe and quality food products.**	
	Student Competencies	
	7.7.9	Outline procedures to assign quality and yield grades to food products according to industry standards.
	7.7.10	Evaluate care and handling procedures to maintain original food quality and yield.
	7.7.11	Respond to consumer concerns about the inspection and harvesting techniques of animals using accurate information based on regulatory agency approved or industry-approved techniques.
	7.7.12	Evaluate food products from different classifications of food products.
Topic 7.8	**Design and apply techniques of food processing, preservation, packaging, and presentation for distribution and consumption of food products.**	
	Student Competencies	
	7.8.9	Design plans to formulate and package food products using a variety of weights and measures.
	7.8.10	Evaluate food quality factors on foods prepared for different markets (e.g., shelf life, shrinkage, appearance, weight, etc.).
	7.8.11	Recommend strategies to preserve different foods using various methods and techniques.
	7.8.12	Implement methods of selecting packaging materials to store a variety of food products.
Topic 7.9	**Create food distribution plans and procedures to ensure safe delivery of food products.**	
	Student Competencies	
	7.9.7	Defend a strategy to determine ways for food distribution to reduce environmental impacts.
	7.9.8	Make recommendations to improve safety procedures used in food distribution scenarios to ensure a safe product is being delivered to consumers.
	7.9.9	Propose distribution plans for food products that meet specific market demands.
Topic 7.10	**Examine the scope of the food industry by evaluating local and global policies, trends, and customs for food production.**	
	Student Competencies	
	7.10.7	Defend a personal point of view on policies and legislation that affect the food products and processing system in the U.S. or internationally
	7.10.8	Create food products that meet a specific consumer trend in a specific market.
	7.10.9	Design culturally sensitive food processing and distribution practices.
Topic 7.11	**Evaluate the significance and implications of changes and trends in the food products and processing industry in the local and global food systems.**	
	Student Competencies	
	7.11.7	Predict upcoming changes and trends in the food products and processing industry.
	7.11.8	Respond to consumer concerns about the environment and safety of the food supply using accurate information regarding food products and processing systems and practices.
	7.11.9	Evaluate the feasibility of implementing a current or emerging technology to improve a current food product or process used in a facility.
Topic 7.12	**Identify the purpose of industry organizations, groups, and regulatory agencies that influence the local and global food systems.**	

Student Competencies		
	7.12.5	Create methods to obtain data about organizations, groups, and regulatory agencies that affect the food products and processing industry.
	7.12.6	Create plans that ensure adherence to industry standards for food products and processing facilities.
Topic 7.13	**Evaluate the effectiveness of current sustainability practices in their role to food products and processing**	
Student Competencies		
	7.13.5	Create a plan to educate on what food sustainability is.
	7.13.6	Design a program for a facility to promote sustainable food production, distribution, and waste.

Standard 8	*NATURAL RESOURCES SYSTEMS*	
Topic 8.1	**Examine natural resource availability and ecosystem function in a particular region.**	
	Student Competencies	
	8.1.7	Devise strategies for the management (e.g., preservation, conservation, exploitation, etc.) of natural resources.
	8.1.8	Evaluate the interdependence of biotic and abiotic components (climate, geography, energy flow, nutrient cycling, etc.) in an ecosystem.
	8.1.9	Evaluate biodiversity in ecosystems and devise strategies to enhance the function of an ecosystem and the availability of natural resources by increasing the level of biodiversity.
Topic 8.2	**Classify different types of natural resources in order to enable protection, conservation, enhancement, and management in a particular geographical region.**	
	Student Competencies	
	8.2.13	Evaluate the species of trees present to assess the status of an ecosystem (e.g., presence of native versus invasive species, biodiversity, etc.).
	8.2.14	Evaluate the species of herbaceous plants present to assess the status of an ecosystem (e.g., presence of native versus invasive plants, biodiversity, etc.).
	8.2.15	Evaluate the species of wildlife and insects present to assess the status of an ecosystem.
	8.2.16	Evaluate the aquatic species present to assess the status of an ecosystem.
	8.2.17	Evaluate the abiotic resources present in an area to determine the best practices for improving, enhancing, and protecting an ecosystem.
	8.2.18	Interpret resource inventories and population studies in a given area over time.
Topic 8.3	**Apply ecological concepts and principles (e.g., weather, air quality, UV protection, atmospheric pressure, etc.) to the interaction of atmospheric and natural resource systems.**	
	Student Competencies	
	8.3.5	Make recommendations to lessen the impact of human activity on the ability of the atmosphere to regulate biogeochemical cycles.
	8.3.6	Design strategies to address the primary causes of climate change and their impact on natural resource systems.
Topic 8.4	**Apply ecological concepts and principles to aquatic natural resource systems.**	
	Student Competencies	
	8.4.9	Evaluate the importance of watersheds to ecosystem function.
	8.4.10	Evaluate strategies to manage, protect, enhance, or improve sources of groundwater or surface water based on its properties.
	8.4.11	Evaluate strategies for the creation, enhancement, and management of riparian zones and riparian buffers.
	8.4.12	Evaluate strategies for the creation, enhancement, and management of stream bank erosion.
Topic 8.5	**Apply ecological concepts and principles to terrestrial natural resource systems.**	
	Student Competencies	
	8.5.9	Predict which species will become more prevalent through future stages of succession in an ecosystem.

	8.5.10	Interpret signs of habitat disturbances and resilience in an ecosystem to assess the health of an ecosystem.
	8.5.11	Devise a forest management plan that improves the habitat while optimizing the amount or quality of timber that can be harvested.
	8.5.12	Devise a soil management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.
Topic 8.6	**Apply ecological concepts and principles to biotic organisms in natural resource systems.**	
	Student Competencies	
	8.6.5	Create a management plan for a population of a species in an ecosystem given its population ecology, population density, and population dispersion in natural resource systems.
	8.6.6	Devise a plan to manage, prevent, control, or eliminate invasive species in a given area.
Topic 8.7	**Examine and interpret the purpose, enforcement, impact, and effectiveness of laws, agencies, and private and public organizations related to natural resource management, protection, enhancement, and improvement (e.g., water regulations, game laws, environmental policy, local, state, and national conservation organizations, agricultural extension service, etc.).**	
	Student Competencies	
	8.7.5	Evaluate the impact of laws and treaties associated with natural resources systems (e.g., mitigation, water regulations, carbon emissions, game limits, invasive species, etc.).
	8.7.6	Evaluate the impact and effectiveness of agencies and organizations associated with natural resources systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.).
Topic 8.8	**Assess the impact of human activities on the availability of natural resources.**	
	Student Competencies	
	8.8.7	Evaluate how the availability of natural resources can be improved through changes to human activity.
	8.8.8	Devise a strategy for preventing the loss of species and biodiversity that takes into account the primary causes of species extinction from human activity.
	8.8.9	Design a solution to reduce the depletion of natural resources affected by consumer decisions.
Topic 8.9	**Analyze how social perceptions of natural resource management, protection, enhancement, and improvement change and develop over time.**	
	Student Competencies	
	8.9.7	Develop predictions for how the management, protection, enhancement, and improvement of natural resources will evolve through social perceptions (e.g., establishment of national parks, public opinion, reduction of waste and energy consumption, partnership with tribal communities, etc.).
	8.9.8	Predict how society's views and use of natural resources will continue to change as a result of historical figures and trends in modern society.
	8.9.9	Predict how future technological advancements may affect the use and views of natural resources.
Topic 8.10	**Examine and explain how economics affects the use of natural resources.**	
	Student Competencies	

	8.10.7	Devise a plan to improve the conservation, protection, improvement, and enhancement of natural resources based on economic value and practices.
	8.10.8	Predict how changes to the availability of natural resources because of human activity may impact a local, tribal, state, and national economy.
	8.10.9	Predict the economic impact of green technology and alternative energy.
Topic 8.11	**Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources.**	
	Student Competencies	
	8.11.7	Devise a strategy for communicating a natural resources message through media.
	8.11.8	Predict how messages about the conservation, management, enhancement, and improvement of natural resources will change because of social media and the Internet.
	8.11.9	Create a communication plan to influence the behavior of people, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources.
Topic 8.12	**Sustainably produce, harvest, process, and use natural resource products (e.g., forest and rangeland products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).**	
	Student Competencies	
	8.12.17	Develop a forest harvesting plan that ensures economic, environmental, and social sustainability.
	8.12.18	Develop a method for the sustainable harvest of wildlife species.
	8.12.19	Evaluate methods used to extract and process minerals for economic, environmental, and social sustainability.
	8.12.20	Evaluate methods used to extract and process fossil fuels for economic, environmental, and social sustainability.
	8.12.21	Evaluate methods used to extract and process shale oil for economic, environmental, and social sustainability.
	8.12.22	Predict how the impact of alternative energy will change in the future based on trends in energy production and consumption.
	8.12.23	Recommend how an outdoor recreation activity can be made more sustainable in a manner that is accessible and equitable to those who take part in that activity.
	8.12.24	Develop recommendations for the sustainable harvest of aquatic species.
Topic 8.13	**Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing and evaluating natural resource management plans.**	
	Student Competencies	
	8.13.5	Evaluate the availability of and threats to natural resources using cartographic skills, tools, and technologies (e.g., spread of invasive species, movement of wildlife populations, changes to biodiversity of edge of habitat versus interior, etc.).
	8.13.6	Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.
Topic 8.14	**Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.**	
	Student Competencies	
	8.14.13	Create an enhancement plan for a stream.
	8.14.14	Create a timber stand improvement plan for a forest.

	8.14.15	Devise a comprehensive improvement plan for a wildlife habitat.
	8.14.16	Revise a rangeland management plan to support the provisioning of multiple ecosystem services.
	8.14.17	Evaluate the impact of recreational activities on natural resources.
	8.14.18	Create an improvement plan for marine or coastal natural resources.
Topic 8.15	**Diagnose plant and wildlife diseases and follow protocols to prevent their spread.**	
	Student Competencies	
	8.15.5	Create a management plan to reduce infection and the spread of plant diseases in natural resource systems.
	8.15.6	Create a management plan to reduce infection and spread of wildlife or aquatic species diseases in natural resource systems.
Topic 8.16	**Prevent or manage introduction of ecologically harmful species in a particular region.**	
	Student Competencies	
	8.16.5	Create a management plan to reduce the spread of ecologically harmful species in natural resource systems.
	8.16.6	Devise strategies to prevent ecological damage that would result from the introduction of an ecologically harmful species.
Topic 8.17	**Manage fires in natural resource systems.**	
	Student Competencies	
	8.17.5	Develop a prevention plan for harmful fires for a particular region.
	8.17.6	Predict how fire management techniques will change in the future.

Standard 9	*PLANT SYSTEMS*	
Topic 9.1	**Determine the influence of environmental factors on plant growth.**	
	Student Competencies	
	9.1.7	Recommend modifications to light for desired plant growth.
	9.1.8	Evaluate a plan to maintain optimal environmental conditions for plant growth (e.g., day length, light, humidity, moisture, temperature, etc.).
	9.1.9	Recommend modifications to water for desired plant growth.
Topic 9.2	**Prepare and adjust growing media for use in plant systems.**	
	Student Competencies	
	9.2.5	Recommend a plan for managing crop growth in different growing media.
	9.2.6	Determine the electroconductivity and pH for soil and how the results influence practices (e.g., irrigation, etc.).
Topic 9.3	**Demonstrate planting techniques and create the conditions needed for seed germination.**	
	Student Competencies	
	9.3.3	Recommend a crop to plant given a geographic region.
Topic 9.4	**Develop and implement a nutrient management and/or fertilizer plan for specific plants or crops.**	
	Student Competencies	
	9.4.11	Prepare a scouting report to correct elements negatively affecting plant growth in a field or greenhouse.
	9.4.12	Recommend a plan of action to adjust the electric conductivity (EC, soluble salts) and pH of growing media given soil tests for specific plants or crops.
	9.4.13	Prescribe fertilizer applications based on the results of a laboratory analysis of soil and plant tissue samples.
	9.4.14	Recommend a fertilizer application method (e.g., liquid, dry, variable rate, manure, etc.).
	9.4.15	Devise a plan for sustainable soil management for a selected cropping system.
Topic 9.5	**Classify plants according to taxonomic systems.**	
	Student Competencies	
	9.5.3	Assess the importance of plants to agricultural and ornamental plant systems by scientific names.
Topic 9.6	**Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.**	
	Student Competencies	
	9.6.13	Compare and contrast mitosis and meiosis.
	9.6.14	Evaluate the active and passive transport of minerals into and through the root system to plant nutrition.
	9.6.15	Evaluate the function of the xylem, phloem, and cambium tissues and their impact on plant systems.
	9.6.16	Devise a plan for agronomic management practices that takes into account leaf structure, function, and environmental factors (e.g., drought vs. humid conditions, adding adjuvants to spray solutions for successful pesticide applications, etc.).
	9.6.17	Evaluate the impact of plant and flower structure on plant breeding, production, and use.
	9.6.18	Evaluate the impact of different seed and fruit structures to plant culture and use.

Topic 9.7	**Apply knowledge of plant physiology and energy conversion to plant systems.**	
	Student Competencies	
	9.7.11	Evaluate the factors that affect photosynthesis and the impact those factors have on plant management and production problems.
	9.7.12	Evaluate the impact of plant respiration on plant growth, crop management, and post-harvest handling decisions.
	9.7.13	Relate the principles of primary and secondary growth to plant systems.
	9.7.14	Recommend the use of specific plant growth regulators to produce desired responses from plants (e.g., adding PGRs to a spray solution, etc.).
	9.7.15	Recommend plant management strategies that apply knowledge of transpiration, translocation, and assimilation on plant growth.
Topic 9.8	**Demonstrate plant propagation techniques in plant system activities.**	
	Student Competencies	
	9.8.11	Justify the use of pollination methods and practices used to maximize crop pollination (e.g., honey bee, leaf cutter bee, wind, ratio of males to females planted, etc.).
	9.8.12	Conduct tests associated with seed germination rates, viability, and vigor.
	9.8.13	Evaluate asexual propagation practices comparing productivity, efficiency, and cost.
	9.8.14	Recommend micropropagation techniques in a given scenario.
	9.8.15	Evaluate the impact of using genetically modified agricultural and ornamental crops on other production practices.
Topic 9.9	**Develop and implement a management plan for plant production.**	
	Student Competencies	
	9.9.15	Demonstrate ways to produce pest- and disease-free propagation material.
	9.9.16	Assess how mechanical planting equipment performs soil preparation and seed placement.
	9.9.17	Recommend the calibration for mechanized seeding and/or planting equipment for a desired seed application rate.
	9.9.18	Prepare a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.).
	9.9.19	Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time.
	9.9.20	Recommend technology for use in controlled atmosphere production.
	9.9.21	Recommend the use of a hydroponic or aquaponic plant system.
Topic 9.10	**Develop and implement a plan for integrated pest management for plant production.**	
	Student Competencies	
	9.10.9	Devise solutions for plant pests, diseases, and disorders.
	9.10.10	Design a crop scouting program.
	9.10.11	Employ pest management strategies to manage pest populations, assess the effectiveness of the plan, and adjust the plan as needed.
	9.10.12	Evaluate environmental and consumer concerns regarding pest management strategies.

Topic 9.11	**Apply principles and practices of sustainable agriculture to plant production.**	
	Student Competencies	
	9.11.7	Design plans for a plant systems enterprise that aligns with USDA sustainable practices criteria.
	9.11.8	Recommend the use of nationally/internationally grown or locally/regionally grown for a production operation system.
	9.11.9	Evaluate evidence supporting claims on how environmental conditions affect plant production.
Topic 9.12	**Harvest crops according to industry standards.**	
	Student Competencies	
	9.12.5	Demonstrate mechanical harvesting practices used to process plant crops.
	9.12.6	Recommend strategies to reduce crop loss given specific crop yield and loss data.
Topic 9.13	**Haul and store crops according to industry standards.**	
	Student Competencies	
	9.13.7	Demonstrate practices that govern safe plant production, distribution, and use/consumption.
	9.13.8	Evaluate environmental conditions in storage facilities for plants and plant products.
	9.13.9	Evaluate techniques for grading, handling, and packaging plants and plant products.

Standard 10	***POWER, STRUCTURAL, AND TECHNICAL SYSTEMS***	
Topic 10.2	**Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.**	
	Student Competencies	
	10.2.7	Design a plan to improve the efficiency of operation of AFNR related mechanical systems.
	10.2.8	Design a process to implement the safe use of AFNR related tools, machinery, and equipment.
	10.2.9	Develop a safety plan for different AFNR related mechanical systems ensuring compliance with industry standards.
Topic 10.4	**Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.**	
	Student Competencies	
	10.4.5	Design a plan to communicate processes and procedures (e.g., lockout/tagout (LOTO), safety harnesses, etc.) for, preventative maintenance and service schedule for equipment, machinery, and power units used in AFNR power, structural and technical systems.
	10.4.6	Assess equipment according to service specifications. (e.g., belts and drives, chains, sprockets, hoses, lines, nozzles, etc.).
Topic 10.5	**Operate machinery and equipment while observing all safety precautions in AFNR settings.**	
	Student Competencies	
	10.5.5	Analyze the efficiency of equipment, machinery, and power units (e.g., theoretical field capacity, actual field capacity, return on investment, etc.).
	10.5.6	Adjust equipment, machinery, and power units for safe and efficient operation.
Topic 10.7	**Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.**	
	Student Competencies	
	10.7.7	Design electrical circuits using knowledge of the basic units of electricity and code.
	10.7.8	Evaluate malfunctioning electrical components and systems using testing procedures and equipment service/technical manuals.
	10.7.9	Build electrical control circuits to ensure proper operation.
Topic 10.14	**Apply current and/or identify emerging technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.**	
	Student Competencies	
	10.14.5	Solve problems using current and emerging technologies for AFNR systems.
	10.14.6	Create recommendations for the use of technology in AFNR systems.
Topic 10.15	**Prepare and/or use electrical drawings to design, install, and troubleshoot electronic control systems in AFNR settings.**	

Student Competencies		
	10.15.7	Design schematic drawings for electrical control systems.
	10.15.8	Troubleshoot and install electrical sensors.
	10.15.9	Develop a plan for using programmable logic controllers (PLC), microcontrollers, and/or other computer-based systems.
Topic 10.16	**Apply geospatial principles and technologies to solve problems and increase the efficiency of AFNR systems.**	
Student Competencies		
	10.16.5	Analyze and interpret data from maps utilizing geospatial technologies.
	10.16.6	Install new and troubleshoot faulty instrumentation and equipment used for precision technologies (i.e., GPS receivers, yield monitors, remote sensors, etc.).