# Agricultural and Environmental Systems Career Field

## Animal Science and Technology

**Subject Code: 010910**

**Outcome & Competency Descriptions**

**Course Description:**

Students will learn and apply responsible animal management principles and routine husbandry practices. Topics will include nutrition, feeding, and caring for animals, body/carcass composition evaluation, and applying marketing principles to the sale and distribution of animal products. Learners will investigate animal genetics and how it impacts principles of animal improvement, selection and marketing. Throughout the course, learners will develop business leadership, problem-solving and communication skills in relation to the science of animals.

**Strand 1. Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**Outcome: 1.1. Employability Skills**

Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

**Competencies**

1.1.1. Identify the knowledge, skills and abilities necessary to succeed in careers.

1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.3. Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.

**Outcome: 1.2. Leadership and Communications**

Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

**Competencies**

1.2.1. Extract relevant, valid information from materials and cite sources of information.

1.2.2. Deliver formal and informal presentations.

1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.4. Use negotiation and conflict-resolution skills to reach solutions.

1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.

1.2.6. Use proper grammar and expression in all aspects of communication.

1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.

1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence internal and external workplace relationships.

1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications (e.g., common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity).

1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a team.

1.2.11. Write professional correspondence, documents, job applications and resumés.

1.2.12. Use technical writing skills to complete forms and create reports.

1.2.13. Identify stakeholders and solicit their opinions.

1.2.14. Use motivational strategies to accomplish goals.

**Outcome: 1.3. Business Ethics and Law**

Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

**Competencies**

1.3.1. Analyze how regulatory compliance (e.g., United States Department of Agriculture [USDA], Food and Drug Administration [FDA], United States Department of Interior [USDI], Ohio Livestock Care Standards, water quality standards, local water regulations, building codes) affects business operations and organizational performance.

1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.

**Outcome: 1.4. Knowledge Management and Information Technology**

Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

**Competencies**

1.4.2. Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).

1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

**Outcome: 1.6. Business Literacy**

Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

**Competencies**

1.6.7. Identify the effect of supply and demand on products and services.

**Outcome: 1.10. Sales and Marketing**

Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.

**Competencies**

1.10.2. Determine the customer's needs and identify solutions.

1.10.3. Communicate features, benefits and warranties of a product or service to the customer.

**Outcome: 1.11. Principals of Business Economics**

Examine and employ economic principles, concepts and policies to accomplish organizational goals and objectives.

**Competencies**

1.11.3. Use economic indicators to identify economic trends and conditions (e.g., inflation, interest rate fluctuations, unemployment rates).

1.11.4. Determine how the quality, quantity and pricing of goods and services are affected by domestic and international competition in a market economy.

1.11.8. Identify the relationships between economy, society and environment that lead to sustainability.

**Strand 2. Animal Science**

Learners apply principles of animal anatomy, physiology, genetics, behavior, nutrition and production to the research and development, selection and reproduction, health, and management of animals in domestic and natural environments.

**Outcome: 2.1. Nutrition**

Analyze, formulate, prepare, and administer a ration for a population of specific animal species based on economics, nutrition and availability of feedstuffs and evaluate the feed’s effects on animals and animal products.

**Competencies**

2.1.1. Identify the traditional and alternative types, compositions, quality and compatibility of feedstuffs, feed additives and feed byproducts.

2.1.2. Describe the role of nutrients and the nutritional requirements of different animal life processes and species.

2.1.3. Collect a feedstuff sample and interpret the data to determine the quality.

2.1.4. Identify and address major nutrient deficiency and toxicity symptoms.

2.1.5. Identify the biological and non-biological (physical, chemical, biological, and radiological) contaminants found in feedstuffs and their impacts on animals.

2.1.6. Formulate and prepare rations and diets for different stages of an animal’s life.

2.1.7. Calculate performance indicators (feed efficiency, average daily gain, minimum energy required) in relation to the cost, quality, and availability of feeds.

2.1.8. Select and determine the feeding and watering practices and systems, based on the animal population, purpose and requirement.

**Outcome: 2.2. Body Systems**

Describe the interrelationships of animal body systems with growth, development, health, maintenance, reproduction, and production.

**Competencies**

2.2.1. Describe external anatomical parts and their functions within different species.

2.2.2. Compare and contrast the anatomical parts of the digestive system(s) and describe their physiology within different species.

2.2.4. Identify the anatomical components of the skeletal system, including the types and forms of bones, and describe their physiology.

2.2.5. Identify the anatomical components of the musculature systems, including striated, cardiac, and smooth muscle, and describe their physiology.

2.2.6. Compare and contrast bone growth, muscle growth, and fat deposition in relation to developmental patterns.

2.2.12. Compare and contrast between the male and female reproductive system, structures, and functions.

2.2.13. Describe the endocrine system, its structure and the role of hormones.

**Outcome: 2.3. Care and Management**

Apply animal care, management, and record procedures to ensurehusbandry and welfare, including managing environmental conditions to ensure health and performance.

**Competencies**

2.3.1. Identify species-specific terminology (gender, age, reproductive status).

2.3.2. Identify, classify, evaluate, and select animal species or breeds for a desired outcome.

2.3.3. Determine the biotic and abiotic factors (e.g., air, ventilation) that impact the animals’ environment.

2.3.4. Apply concepts of pest control, nuisance animal control, sanitation and disinfection procedures for the animals’ care and management.

2.3.5. Perform species-specific animal identification techniques for traceability and records.

2.3.6. Calculate a facility or habitat's carrying capacity and its impact on animal health.

2.3.7. Identify and recognize predator-prey relationships and implement control measures.

2.3.8. Evaluate and perform animal care procedures aligned with industry standards throughout the life of the animal.

2.3.9. Monitor and evaluate the quality of an animal’s habitat and implement corrective methods as needed.

2.3.10. Recognize common restraints and tack devices for handling including their use and adjustments.

**Outcome: 2.4. Recognizing Diseases and Disorders**

Evaluate animal conditions for species-specific diseases and disorders to assess an animal’s health and welfare.

**Competencies**

2.4.1. Identify common infectious and noninfectious causes of diseases and disorders within different species.

2.4.2. Identify abnormalities in the skeleton, body form and functions and identify associated symptoms.

2.4.3. Describe the clinical signs that are associated with an abnormality caused by environmental factors (e.g., heat stress, standing condition, air quality).

2.4.5. Describe zoonotic diseases and explain the health risk on humans and animals.

**Outcome: 2.5. Animal Health**

Implement preventive measures, treatment and maintenance options for species-specific diseases and disorders to improve an animal’s health and welfare.

**Competencies**

2.5.1. Obtain and interpret an animal's vitals.

2.5.2 Apply concepts of body condition scoring to assess an animal's general health and nutrition status.

2.5.3. Recognize the preventative measures or treatments needed to maintain animal health.

2.5.4. Apply basic principles of first aid.

2.5.6. Describe the routes of administration for medications (oral, IM, IV, SQ) and the process of drug absorption, distribution, metabolism, withdrawal, and excretion.

2.5.7. Interpret and follow label directions for the dosage, route of administration and withdrawal period.

**Outcome: 2.6. Population Management**

Manage reproduction practices in animal populations across habitats to achieve the desired outcomes and specific goals.

**Competencies**

2.6.1. Identify factors that lead to reproductive maturity and select animals for reproductive readiness.

2.6.2. Compare and select superior individuals based on phenotype.

2.6.3. Compare and select superior individuals based on breeding values and heritability of the desired traits.

2.6.4. Identify normal and abnormal signs of parturition and recommend appropriate management practices.

2.6.5. Understand the rationale to manipulate an animal’s reproductive processes to support breeding (e.g., sex-sorted semen, heat synchronization, nutritional flushing, light cycling, natural and selective breeding).

2.6.6. Understand the rationale for selecting breeding methods (e.g., artificial insemination, embryo transfer, natural selection, selective breeding, invitro fertilization, cloning).

2.6.7. Describe requirements and environmental influences during different stages of gestation within different species.

2.6.8. Describe ethical and responsible animal population management practices (e.g., spaying, neutering, heat suppression, relocation, reintroduction, hunting, containment, culling, euthanasia).

**Strand 3. Biotechnology**

Learners engage in the scientific process, learn fundamental processes using modern tools and laboratory techniques, adhere to safety protocols, and bring a biotechnology product to the market.

**Outcome: 3.6 Molecular-Genetics Technology**

Apply knowledge of genetic inheritance and modification to organisms and use genetic information and bioinformatics to analyze specimens.

**Competencies**

3.6.1. Use a Punnett Square to predict and explain Mendel’s Laws, genotype, and phenotype.

3.6.4. Model central dogma of molecular biology (e.g. replication, transcription, translation).

3.6.18. Describe artificial selection and how it is used in plant and animal breeding.

3.6.22. Describe the difference between a quantitative and qualitative gene trait and give examples of each.

**Strand 4. Power Systems**

Learners apply principles of tool use, power transmission, hydraulics, two- and four-stroke cycle combustion, exhaust, ignition, starting and charging, steering and lubrication systems to operate, to maintain ~~or~~ and repair equipment.

**Outcome: 4.1. Tool, Stationary and Mobile Equipment Maintenance**

Inspect, clean, maintain and perform preventative maintenance on equipment.

**Competencies**

4.1.2. Identify types of hand tools, power tools and equipment and describe their functions.

4.1.4. Identify potential hazards and limitations related to the use of equipment.

4.1.5. Maintain organization, and cleanliness of facilities, machinery, equipment, and tools for safety and appearance.

**Strand 5 Elements of Production**

Learners apply principles of practice related to the management and maintenance of food, agriculture, and natural resources systems.

**Outcome: 5.15 Animal Behavior**

Apply management practices to assure animal welfare considering species-specific behaviors, human safety, social influences, public perception, and regulations associated with animal welfare.

**Competencies**

5.15.1 Understand social influences, public perception and regulations that are associated with animal welfare.

5.15.2 Describe the adaptations and special senses (e.g., sight, hearing, smell, touch) of animals and how they contribute to animal behavior.

5.15.3 Identify and describe the innate behavioral patterns of animals.

5.15.4 Describe social relationships involved in behavioral adjustment and adaptation (e.g., animal-to-animal and human-to-animal interaction).

5.15.5 Interpret an animal’s intent based on its vocalization, body posture and chemical means of communication.

5.15.6. Recognize behavioral abnormalities and recommend corrective action.

5.15.7 Humanely handle, restrain, and move animals.

5.15.8 Identify and describe the life expectancy and use of animals.

5.15.9 Identify and describe the impacts of animal welfare and handling on meat quality and food safety.

5.15.10 Compare and contrast proper and improper handling, equipment uses, and strategies that impact food quality.

5.15.11 Identify methods to minimize animal stress and safety (physiology, psychological and nutritional).

5.15.12 Examine an animal to evaluate its general condition.

**Outcome 5.16. Biosecurity**

Connect the sources and causes of contamination and develop the protocols to implement biosecurity procedures.

**Competencies**

5.16.4. Assess a facility's biosecurity, classify the level of risk, and recommend improvements.

5.16.5. Implement biosecurity procedures to prevent cross-site contamination (e.g., proper use and disposal of personal protective equipment [PPE] from site to site, vehicle cleaning between farm and processing site).

5.16.6. Screen and test animals and plant products for infectious agents or contamination.

5.16.7 Select bio-containment practices (e.g., quarantine, eradicate, showering into facilities) to manage pests and diseases.

**Strand 6. Environmental Science**

Learners apply earth, life, and physical sciences to the production, extraction, processing, protection, use, and renewal of both renewable and non-renewable resources.

**Outcome: 6.7. Solid Waste and Renewable Resource Management**

Control and process solid waste using current and alternative technologies.

**Competencies**

6.7.1. Collect, analyze, and treat solid waste materials (e.g., livestock mortalities, manure, garbage, food waste).

6.7.2. Distinguish the risks associated with solid waste accumulation, utilization, and disposal.

6.7.6. Describe and monitor solid waste management methods (e.g., composting, incineration, recycling, burial, bio digester).

6.7.7. Explain the control processes and potential uses for solid waste byproducts (e.g., leachate, ash, landfill gas, biosolids, methane, manure).

**Strand 7. Food Science**

Learners apply principles of biology, chemistry and physics to the research, development, production, processing and distribution of food products meeting food safety and quality assurance standards in a secure system.

**Outcome: 7.1. The Science of Food**

Differentiate the structures, functions and sources of ingredients and the roles they play in food product development for human nutrition.

**Competencies**

7.1.7. Relate the functions and physical properties of simple and complex carbohydrates, lipids, vitamins, minerals and proteins (i.e., functional ingredients) to the manufacturing of food products.

**Outcome: 7.3. Meat Science**

Identify the role of inspection, sanitation, food safety, and proper harvesting practices; the role of carcass evaluation and grading on meat quality and percent saleable products and cutting guidelines from primal to retail meat cuts.

**Competencies**

7.3.3. Describe humane harvesting techniques and their impact on meat quality.

7.3.10. Calculate the percentage of saleable products from yield grades utilizing the USDA formula in estimating percent boneless closely trimmed retail cuts.

7.3.11. Calculate beef carcass value using a grid-based marketing system.

7.3.12. Fabricate carcasses into species-specific wholesale and retail cuts.

**Outcome: 7.4. Food Production and Processing**

Process a safe shelf stable food product for distribution and consumption.

**Competencies**

7.4.5. Identify and apply food grading systems and standards of identity.

7.4.8. Process food products through biological processing.

7.4.10. Determine the environmental impacts and manage the waste of processing a food product.

**Strand 8. Plant Science**

Learners apply principles of plant anatomy, physiology, nutrition and genetics to the research and development, selection and reproduction, planting, fertilization, health, harvesting and management of plants in a domestic and/or natural environment.

**Outcome: 8.1. Plant Nutrition**

Select and apply macronutrients and micronutrients based on deficiencies identified from the use of industry-driven testing, application, methods and optimum management strategies that account for environmental factors.

**Competencies**

8.1.1. Compare and contrast organic and inorganic sources of macronutrients and micronutrients.

**Strand 9. Energy**

Learners apply principles of physics, chemistry, the earth sciences and mathematics to energy sources, transformations, acquisitions, applications, and their impacts.

**Outcome: 9.1. Energy**

Identify energy sources according to their economic viability, sustainability, and environmental impact.

**Competencies**

9.1.7. Identify and describe best management practices (e.g., carbon sequestration, conservation, animal safety, efficiency) that lessen environmental impact.