

Agriculture, Food, and Natural Resources (AFNR) Frameworks 2021

## Section 4 – Animal Systems (AS) Pathway Frameworks

### Introduction

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

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### Recommended AS Courses and Pathway Sequence

Students concentrating on the AS pathway should complete a sequence of at least two courses within the following course offerings based their career goals and interests.

| **Introductory Courses** | **Intermediate Courses** | **Advanced Courses** |
| --- | --- | --- |
| 01 Principles of Agriculture, Food, and Natural Resources02 Advanced Principles of Agriculture, Food, and Natural Resources03 Principles of AFNR Biology (Science-Elective Credit)04 Advanced Principles of AFNR Biology (Science-Elective Credit)15 Animal Science and Small Animal Care16 Advanced Animal Science and Large Animal Care17 Animal Biology (Science-Elective Credit)18 Advanced Animal Biology (Science-Elective Credit) | 19 Equine Science20 Livestock and Poultry Production21 Livestock, Poultry, and Equine Operations (Simulated WBL: School Farm)22 Aquaculture Operations (Simulated WBL: School Farm)23 Aquacultural Chemistry (Science Credit; Simulated WBL: School Farm)24 Veterinary Science25 Advanced Veterinary Science26 Veterinary Biology (Science-Elective Credit)27 Adv. Veterinary Biology (Science-Elective Credit)28 Small Animal Care Operations (Simulated WBL: School Business) | 13 Agricultural Education, Research, and Development29 Specialty and Emerging Animal Systems Topics75 Food Science76 Advanced Food Science77 Food Chemistry (Science Credit)78 Advanced Food Chemistry (Science Credit)85 Animal and Plant Biotechnology86 Advanced Animal and Plant Biotechnology87 Agricultural Biotechnology and Biology (Science-Elective Credit)88 Advanced Agricultural Biotechnology and Biology (Science-Elective Credit)93 Extended/Summer AFNR Work-Based Learning (SAE) and Leadership (FFA)94 Agricultural Leadership Development95 Agricultural Career Seminar96 Advanced Agricultural Career Seminar97 AFNR Work Experience: Immersion SAE (Advanced Internship/Placement, Entrepreneurship, Research) |

### Recommended Work-Based Learning (WBL) and SAEs within AS

A Supervised Agricultural Experience (SAE) is a student-led, instructor-supervised, Work-Based Learning (WBL) experience that results in measurable outcomes within a predefined, agreed upon set of AFNR Technical Standards and Career Ready Practices aligned to a Career Plan of study. SAE teaches technical skills and knowledge within the psychomotor domain of learning. SAE includes both experiential learning (i.e., pre-WBL) and WBL (federally defined as sustained interactions with industry or community professionals in real workplace settings, to the extent practicable, or simulated environments, at an educational institution that foster in-depth, firsthand engagement with the tasks required in a given career field, that are aligned to curriculum and instruction; Sec. 3 [20 U.S.C. 2302] 55).

SAE/WBL is a required component of an AFNR program, first established in the Smith-Hughes Act (1917) and reinforced in each of the federal Perkins Career and Technical Education (CTE) Acts (1984 – I; 1990 – II;
1998 – III; 2006 – IV; 2018 – V, Public Law No. 115-224). Minnesota also requires WBL/SAE as a component of CTE Program Approval (Minn. R. 3505). Table 1 has example SAE opportunities within this pathway, as defined by the National Council for AFNR Education, Perkins V legislation, and the Minnesota Department of Education.

#### Table 1. Examples of WBL/SAE Curricula and Programs within AS

| **SAE Program Area** | **Examples, Non-Exhaustive** |
| --- | --- |
| Experiential Learning (Foundational SAE; Pre-WBL) | * Career exploration
* Showing or judging livestock
* Job shadowing in the animal industry
* Field trip to local animal shelter
* Train an animal to perform basic commands
 |
| Internship (Placement SAE; Immersion WBL) | * Working at a Veterinary Clinic/Humane Society/Groomer
* Working for a livestock producer
* Working in a livestock feed processing/testing facility
 |
| Apprenticeship (Placement SAE; Immersion WBL) | * More than 450 hours in an internship, combined with coursework
* Contact MDE for support
 |
| Entrepreneurship (Entrepreneurship SAE; Immersion WBL) | * Breeding/raising animal herd for market animals
* Animal care business (i.e., pet sitting, dog grooming, etc.)
* Livestock fitting and trimming business
 |
| Research (Research SAE; Immersion WBL) | * Consumer research perceptions of grass-fed beef
* Animal weight gain research
* Animal health or reproduction research
 |
| School-Based Enterprise (School-Based SAE; Simulated WBL) | * Aquaculture Operations SBE WBL
* Animal Production/School Farm Operations SBE WBL
* Honey Production/Operations SBE WBL
 |
| FFA Work-Based Learning and SAE Proficiency Award Areas | * Agriscience Research - Animal Systems
* Dairy Production
* Veterinary Science
* Wildlife Production and Management
 |

### Recommended Social-Emotional Learning (SEL) and FFA Opportunities within AS

The National FFA Organization (FFA) is a student-led, instructor-supervised, Career and Technical Student Organization (CTSO) that results in measurable outcomes within a predefined, agreed upon set of AFNR Social-Emotional Standards and Career Ready Practices aligned to a Career Plan of study. FFA teaches social-emotional and leadership skills and knowledge within the affective domain of learning. FFA includes programs that provide essential employability skills such as critical thinking, consensus building, communication, teamwork, and leadership. FFA was founded in 1928 and is federally defined as intracurricular (i.e., within the curriculum; cf. extracurricular: external, co-curricular: alongside) and an integral part (i.e., necessary to form the whole) of School-Based AFNR Education (Public Law No. 116-7).

Leadership/FFA is a required component of an AFNR program, formalized in the FFA Federal Charter in 1950 (Public Law No. 116-7) and reinforced in federal Perkins CTE Acts (1984 – I; 1990 – II; 1998 – III; 2006 – IV;
2018 – V, Public Law No. 115-224). Minnesota also requires leadership/FFA as a component of CTE Program Approval (Minn. R. 3505). Table 2 has example FFA opportunities with this pathway, as defined by the National Council for AFNR Education, Perkins V legislation, Department of Education, and the Minnesota FFA Association.

#### Table 2. Examples of SEL/FFA Curricula and Programs within AS

| **FFA Program Area** | **Examples, Non-Exhaustive** |
| --- | --- |
| Student Development Programs (Growing Leaders) | * Agriscience fair or SAE open house
* Animal facility tours
* Career day/guest speakers
 |
| Community Development/ Service (Building Communities) | * Host a pet supply drive for local animal shelter
* Raising an animal to donate to food shelf
* Raising/training a service animal
 |
| Literacy, Advocacy, and Safety (Strengthening Agriculture) | * CHS Miracle of Birth Barnyard attendant
* Animal welfare project
* Safe animal handling education
* County fair animal exhibit
 |
| Conferences, Conventions, and Banquets | * #FFANextGen Animal Science conference
* InTENse
* Horizon conference
* Livestock industry events (e.g., Cattlemen's Association, Pork Producers, Turkey Growers)
 |
| Career Development Events (CDE) | * Horse Evaluation
* Livestock Evaluation
* Meats Evaluation and Technology
* Milk Quality and Products
* Poultry Evaluation
* Small Animal Veterinary Science
 |
| Leadership Development Events (LDE) | * Agricultural Issues Forum
* Marketing Plan
* Prepared Public Speaking
* Extemporaneous Speaking
 |

### MN.AS.01: History and Trends within Animal Systems

Analyze historic and current trends impacting the animal systems industry.

#### Performance Indicator MN.AS.01.01

Evaluate the development and implications of animal origin, domestication, and distribution on production practices and the environment.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.01.01.01.a. Identify and summarize the origin, significance, distribution, and domestication of different animal species. | AS.01.01.01.b. Describe the historical and scientific developments of different animal industries and summarize the products, services and careers associated with each. | AS.01.01.01.c. Evaluate the implications of animal adaptations on production practices and the environment. |
| AS.01.01.02.a. Research and summarizes the major component areas in different animal systems. | AS.01.01.02.b. Describe several characteristics of animals and evaluate reasoning that led to their domestication. | AS.01.01.02.c. Predict possible trends and their implications within different animal industry and the impact on society and the environment. |

**MN.AS.01: History and Trends within Animal Systems, Continued**

Analyze historic and current trends impacting the animal systems industry.

#### Performance Indicator MN.AS.01.02

Assess and select animal production methods for use in animal systems based upon their effectiveness and impacts.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.01.02.01.a. Identify and categorize terms and methods related to animal production (e.g., sustainable, conventional, humanely raised, natural, organic). | AS.01.02.01.b. Compare and contrast the impact of methods of animal production on the quality of the final product. | AS.01.02.01.c. Evaluate the effectiveness of different production methods and defend the use of selected methods using data and evidence. |
| AS.01.02.02.a. Research and examine marketing methods for animal products and services (e.g., conventional, niche markets, locally grown). | AS.01.02.02.b. Calculate the value of different marketing methods as compared to variable income returns (e.g., direct markets, terminal markets, futures markets). | AS.01.02.02.c. Devise and evaluate marketing plans for an animal agriculture product or service. |
| AS.01.02.03.a. Summarize the types, purposes, and characteristics of effective record keeping and documentation practices for animal systems enterprises (e.g., managing records for animal identification, feeding, breeding, treatment, income/expense). | AS.01.02.03.b. Analyze and evaluate the accuracy and effectiveness of records used in an animal system business. | AS.01.02.02.c. Select and defend the use of a specific record management system based upon its effectiveness for a business related to animal systems. |

**MN.AS.01: History and Trends within Animal Systems, Continued**

Analyze historic and current trends impacting the animal systems industry.

#### Performance Indicator MN.AS.01.03

Analyze and apply laws and sustainable practices to animal agriculture from a global perspective.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.01.03.01.a. Investigate local, national, and global laws pertaining to different animal production systems. | AS.01.03.01.b. Analyze the structure of laws governing animal industries, international trade, and animal production policies. | AS.01.03.01.c. Assess the compliance of production practices with established regulations and evaluate the impact of those laws pertaining to different animal agriculture. |
| AS.01.03.02.a. Summarize the value of sustainability in animals systems. | AS.01.03.02.b. Analyze the local and global impact of sustainable animal agriculture practices on human and environmental systems. | AS.01.03.02.c. Select, evaluate, and defend the use of sustainable practices in animal agriculture. |

### MN.AS.02: Animal Behavior and Welfare

Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.

#### Performance Indicator MN.AS.02.01

Demonstrate management techniques that ensure animal welfare.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.02.01.01.a. Discuss possible implications of different animal welfare and animal rights-based animal systems. | AS.02.01.01.b. Design programs that assure the welfare of animals and prevent abuse or mistreatment. | AS.02.01.01.c. Describe the implementation and evaluation of quality-assurance programs and procedures for animal production. |
| AS.02.01.02.a. Research different management practices to reduce the challenges faced in working with animals. | AS.02.01.02.b. Analyze and document animal welfare procedures used to ensure safety and maintain low stress when handling and working with animals | AS.02.01.02.c. Devise and evaluate safety procedures and plans for working with animals by species using information based on animal behavior and responses. |
| AS.02.01.03.a. Distinguish between animal husbandry practices that promote animal welfare and those that do not. | AS.02.01.03.b. Analyze and document animal husbandry practices and their impact on animal welfare. | AS.02.01.03.c. Design recommendations to increase the welfare of animals while maintaining economic viability. |
| AS.02.01.04.a. Research animal training practices that promote and ensure animal welfare. | AS.02.01.04.b. Analyze and document animal training practices and their impact on animal welfare. | AS.02.01.04.c. Design an animal training program with recommendations to increase the welfare of animals. |

**MN.AS.01: Animal Behavior and Welfare, Continued**

Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.

#### Performance Indicator MN.AS.02.02

Analyze procedures to ensure that animal products are safe for consumption (e.g., use in food system).

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.02.02.01.a. Identify tools, practices, technology, and equipment used in animal systems to help provide an abundant and safe food supply. | AS.02.02.01.b. Utilize tools, practices, technology, and equipment to perform animal husbandry procedures while maintaining welfare standards. | AS.02.02.01.c. Select, evaluate, and defend the use of specific tools, practices, technology, and equipment used to perform animal husbandry and welfare tasks. |
| AS.02.02.02.a. Research and summarize animal production practices that may pose health risks. | AS.02.02.02.b. Compare and discuss current consumer concerns with animal production practices relative to human health. | AS.02.02.02.c. Research and evaluate programs currently used to assure the safety of animal products for consumption. |
| AS.02.02.03.a. Identify and describe current animal tracking systems used in animal systems. | AS.02.02.03.b. Evaluate the different possible impacts of animal trace-back capabilities on producers and consumers. | AS.02.02.03.c. Evaluate the effectiveness of animal and premise identification programs for a given species. |

### MN.AS.03: Animal Nutrition

Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction, and economic production.

#### Performance Indicator MN.AS.03.01

Analyze the nutritional needs and available feed rations in an attempt to meet the animal’s nutritional requirements.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.03.01.01.a. Identify and summarize essential nutrients required for animal health and analyze each nutrient’s role in growth and performance. | AS.03.01.01.b. Differentiate between nutritional needs of animals in different growth/production stages and systems (e.g., maintenance, gestation, natural, organic). | AS.03.01.01.c. Assess nutritional needs for an individual animal based on its growth stage and production system. |
| AS.03.01.02.a. Differentiate between nutritional needs of animal species. | AS.03.01.02.b. Correlate a species’ nutritional needs to possible and available feedstuffs to meet those needs. | AS.03.01.02.c. Design and defend a nutritional program by demonstrating the relationship between the nutrient requirements and the feedstuffs provided. |

#### Performance Indicator MN.AS.03.02

Analyze feed rations and assess if they meet the nutritional needs of animals.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.03.02.01.a. Compare and contrast common types of feedstuffs and the roles they play in the diets of animals. | AS.03.02.01.b. Analyze and calculate the relative nutritional value of feedstuffs by evaluating their general quality and condition. | AS.03.02.01.c. Select appropriate feedstuffs for animals based on a variety of factors (e.g., economics, digestive system, nutritional needs). |
| AS.03.02.02.a. Discuss the importance of a balanced ration for animals based on the animal’s growth stage (e.g., maintenance, newborn, gestation, lactation). | AS.03.02.02.b. Appraise the adequacy of feed rations using data from the analysis of feedstuffs compared to animal requirements and performance. | AS.03.02.02.c. Select and utilize animal feeds based on nutritional requirements, using rations for maximum nutrition, and optimal economic production. |
| AS.03.02.03.a. Summarize the purpose, impact, and mode of action of different feed additives and growth promotants in animal production. | AS.03.02.03.b. Compare and contrast methods that utilize feed additives and growth promotants with production practices that do not (e.g., organic versus conventional production methods). | AS.03.02.03.c. Make and defend decisions regarding whether to use feed additives and growth promotants based on scientific evidence, production system needs and goals, and input from industry standards. |

**MN.AS.03: Animal Nutrition, Continued**

Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction, and economic production.

#### Performance Indicator MN.AS.03.03

Utilize industry tools to make animal nutrition decisions.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.03.03.01.a. Identify and categorize tools and equipment used to meet animal nutrition needs and ensure an abundant and safe food supply. | AS.03.03.01.b. Utilize tools and equipment to perform animal nutrition tasks. | AS.03.03.01.c. Select, evaluate, and defend the use of specific tools or equipment used to perform animal nutrition tasks. |
| AS.03.03.02.a. Examine and summarize the meaning of various components of feed labels and feeding directions. | AS.03.03.02.b. Analyze and apply information from a feed label and feeding directions to feed animals. | AS.03.03.02.c. Evaluate and summarize the potential impacts, positive and negative, of compliance and noncompliance with a feed label and feeding directions. |
| AS.03.03.03.a. Examine the use of technology to provide animal nutrition. | AS.03.03.03.b. Analyze technologies used to provide animal nutrition and summarize their potential benefits and consequences. | AS.03.03.03.c. Research and recommend technology improvements to provide proper nutrition to animals. |

### MN.AS.04: Animal Reproduction

Apply principles of animal reproduction to achieve desired outcomes for performance, development, and economic production.

#### Performance Indicator MN.AS.04.01

Evaluate animals for breeding readiness and soundness.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.04.01.01.a. Identify and categorize the male and female reproductive organs of the major animal species. | AS.04.01.01.b. Analyze the functions of major organs in the male and female reproductive systems. | AS.04.01.01.c. Select breeding animals based on characteristics of the reproductive organs. |
| AS.04.01.02.a. Compare and contrast how age, size, life cycle, maturity level, and health status affect the reproductive efficiency of male and female animals. | AS.04.01.02.b. Assess and describe factors that lead to reproductive maturity. | AS.04.01.02.c. Evaluate and select animals for reproductive readiness. |
| AS.04.01.03.a. Summarize the importance of efficient and economic reproduction in animals. | AS.04.01.03.b. Evaluate reproductive problems that occur in animals. | AS.04.01.03.c. Treat or cull animals with reproductive problems. |

#### Performance Indicator MN.AS.04.02

Apply scientific principles for the selection of breeding animals.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.04.02.01.a. Summarize genetic inheritance in animals. | AS.04.02.01.b. Compare and contrast the use of genetically superior animals in the production of animals and animal products. | AS.04.02.01.c. Select and evaluate a breeding system based on the principles of genetics. |
| AS.04.02.02.a. Identify and summarize inheritance and terms related to inheritance in animal breeding (e.g., dominate, co-dominate, recessive, homozygous, heterozygous). | AS.04.02.02.b. Demonstrate how to determine probability trait inheritance in animals. | AS.04.02.02.c. Select and evaluate breeding animals and determine the probability of a given trait in their offspring. |
| AS.04.02.03.a. Identify and summarize genetic defects that affect animal performance. | AS.04.02.03.b. Analyze how DNA analysis can detect genetic defects in breeding stock. | AS.04.02.03.c. Perform a DNA analysis and use the data to make and defend breeding decisions. |
| AS.04.02.04.a. Identify and summarize different needs of breeding animals based on their growth stages (e.g., newborn, parturition, gestation, gestation lengths). | AS.04.02.04.b. Analyze the care needs for breeding stock in each stage of growth. | AS.04.02.04.c. Create a plan to differentiate care of a species of breeding animals throughout their growth stages. |

**MN.AS.04: Animal Reproduction, Continued**

Apply principles of animal reproduction to achieve desired outcomes for performance, development, and economic production.

#### Performance Indicator MN.AS.04.03

Apply scientific principles to breed animals.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.04.03.01.a. Identify and categorize natural and artificial breeding methods (e.g., natural breeding, artificial insemination, estrous synchronization, flushing, cloning). | AS.04.03.01.b. Calculate the potential economic benefits of natural versus artificial breeding methods. | AS.04.03.01.c. Select animal breeding methods based on reproductive and economic efficiency. |
| AS.04.03.02.a. Analyze the materials, methods, and processes of artificial insemination. | AS.04.03.02.b. Demonstrate artificial insemination techniques. | AS.04.03.02.c. Evaluate the implementation and effectiveness of artificial insemination techniques. |
| AS.04.03.03.a. Identify and summarize the advantages and disadvantages of major reproductive management practices, including estrous synchronization, superovulation, flushing and embryo transfer (e.g., cost, labor, equipment). | AS.04.03.03.b. Analyze the processes of major reproductive management practices, including estrous synchronization, superovulation, flushing and embryo transfer. | AS.04.03.03.c. Create and evaluate plans and procedures for estrous synchronization, superovulation, flushing, embryo transfer, and other reproductive management practices. |
| AS.04.03.04.a. Examine the use of quantitative breeding values (e.g., EPDs, performance records, pedigrees) in the selection of genetically superior breeding stock. | AS.04.03.04.b. Compare and contrast quantitative breeding value differences between genetically superior animals and animals of average genetic value. | AS.04.03.04.c. Select and assess animal performance based on quantitative breeding values for specific characteristics. |

### MN.AS.05: Environmental Factors, Animal Housing, and Safety

Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.

#### Performance Indicator MN.AS.05.01

Design animal housing, equipment, and handling facilities for the major systems of animal production.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.05.01.01.a. Differentiate between the types of facilities needed to house and produce animal species safely and efficiently. | AS.05.01.01.b. Critique designs for an animal facility and prescribe alternative layouts and adjustments for the safe, sustainable, and efficient use of the facility. | AS.05.01.01.c. Design an animal facility focusing on animal requirements, economic efficiency, sustainability, safety, and ease of handling. |
| AS.05.01.02.a. Identify and summarize equipment, technology and handling facility procedures used in modern animal production (e.g., climate control devices, sensors, automation). | AS.05.01.02.b. Analyze the use of modern equipment, technology and handling facility procedures and determine if they enhance the safe, economic, and sustainable production of animals. | AS.05.01.02.c. Select, use, and evaluate equipment, technology, and handling procedures to enhance sustainability and production efficiency. |

#### Performance Indicator MN.AS.05.02

Comply with government regulations and safety standards for facilities used in animal production.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.05.02.01.a. Identify and summarize the general standards that must be met in facilities for animal production (e.g., environmental, zoning, construction). | AS.05.02.01.b. Analyze animal facilities to determine if standards have been met. | AS.05.02.01.c. Evaluate facility designs and make recommendations to ensure that it meets standards for the legal, safe, ethical, economic, and efficient production of animals. |
| AS.05.02.02.a. Distinguish between the types of laws and regulations pertaining to animal systems. | AS.05.02.02.b. Analyze the structure of laws pertaining to animal systems. | AS.05.02.02.c. Evaluate the impact of laws pertaining to animal systems. |

### MN.AS.06: Animal Anatomy and Physiology

Classify, evaluate, and select animals based on anatomical and physiological characteristics.

#### Performance Indicator MN.AS.06.01

Classify animals according to taxonomic classification systems and use (e.g., agricultural, companion).

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.06.01.01.a. Explain the importance of the binomial nomenclature system for classifying animals. | AS.06.01.01.b. Explain how animals are classified using a taxonomic classification system. | AS.06.01.01.c. Assess taxonomic characteristics and classify animals according to the taxonomic classification system. |
| AS.06.01.02.a. Compare and contrast major uses of different animal species (e.g., agricultural, companion). | AS.06.01.02.b. Appraise and evaluate the economic value of animals for various applications in the agriculture industry. | AS.06.01.02.c. Recommend different uses for an animal species based upon an analysis of local market needs. |
| AS.06.01.03.a. Identify and summarize common classification terms utilized in animal systems (e.g., external and internal body parts, maturity, mature male, immature female, animal products, breeds). | AS.06.01.03.b. Analyze the visual characteristics of an animal or animal product and select correct classification terminology when referring to companion and production animals. | AS.06.01.03.c. Apply knowledge of classification terms to communicate with others about animal systems in an effective and accurate manner. |

#### Performance Indicator MN.AS.06.02

Apply principles of comparative anatomy and physiology to uses within various animal systems.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.06.02.01.a. Research and summarize characteristics of a typical animal cell and identify the organelles. | AS.06.02.01.b. Analyze the functions of each animal cell structure. | AS.06.02.01.c. Correlate the functions of animal cell structures to animal growth, development, health, and reproduction. |
| AS.06.02.02.a. Examine the basic functions of animal cells in animal growth and reproduction. | AS.06.02.02.b. Analyze the processes of meiosis and mitosis in animal growth, development, health, and reproduction. | AS.06.02.02.c. Apply the processes of meiosis and mitosis to solve animal growth, development, health, and reproductive problems. |
| AS.06.02.03.a. Identify and summarize the properties, locations, functions and types of animal cells, tissues, organs, and body systems. | AS.06.02.03.b. Compare and contrast animal cells, tissues, organs, body systems types, and functions among animal species. | AS.06.02.03.c. Apply knowledge of anatomical and physiological characteristics of animals to make production and management decisions. |

**MN.AS.06: Animal Anatomy and Physiology, Continued**

Classify, evaluate, and select animals based on anatomical and physiological characteristics.

#### Performance Indicator MN.AS.06.03

Select and train animals for specific purposes and maximum performance based on anatomy and physiology.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.06.03.01.a. Identify and summarize how an animal’s health can be affected by anatomical and physiological disorders. | AS.06.03.01.b. Compare and contrast desirable anatomical and physiological characteristics of animals within and between species. | AS.06.03.01.c. Evaluate and select animals to maximize performance based on anatomical and physiological characteristics that affect health, growth, and reproduction. |
| AS.06.03.02.a. Evaluate an animal against its optimal anatomical and physiological characteristics. | AS.06.03.02.b. Compare and contrast procedures to sustainably and efficiently develop an animal to reach its highest performance potential with respect to its anatomical and physiological characteristics. | AS.06.03.02.c. Choose, implement, and evaluate sustainable and efficient procedures (e.g., selection, housing, nutrition, management) to produce consistently high-quality animals that are well suited for their intended purposes. |
| AS.06.03.03.a. Research and summarize the use of products and by-products derived from animals. | AS.06.03.03.b. Evaluate and select products from animals based on industry standards. | AS.06.03.03.c. Evaluate and select animals to produce superior animal products based on industry standards. |

### MN.AS.07: Animal Care and Health

Apply principles of effective animal health care.

#### Performance Indicator MN.AS.07.01

Design programs for identification, prevention, and treatment of animal diseases, parasites, and other disorders and ensure animal welfare.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.07.01.01.a. Identify and summarize specific tools and technology used in animal health management. | AS.07.01.01.b. Describe and demonstrate the proper use and function of specific tools and technology related to animal health management. | AS.07.01.01.c. Select and use tools and technology to meet specific animal health management goals. |
| AS.07.01.02.a. Explain methods of determining animal health and disorders. | AS.07.01.02.b. Perform simple health-check evaluations on animals and practice basic emergency response procedures related to animals. | AS.07.01.02.c. Determine when an animal health concern needs to be referred to an animal health professional. |
| AS.07.01.03.a. List and summarize the characteristics of wounds, common diseases, parasites, and physiological disorders that affect animals. | AS.07.01.03.b. Identify and describe common illnesses and disorders of animals based on symptoms and problems caused by wounds, diseases, parasites, and physiological disorders. | AS.07.01.03.c. Treat common diseases, parasites, and physiological disorders of animals according to directions prescribed by an animal health professional. |
| AS.07.01.04.a. Identify and summarize characteristics of causal agents and vectors of diseases and disorders in animals. | AS.07.01.04.b. Research and analyze data to evaluate preventive measures for controlling and limiting the spread of diseases, parasites, and disorders among animals. | AS.07.01.04.c. Design and implement health maintenance and a disease and disorder prevention plan for animals in their natural and confined environments. |
| AS.07.01.05.a. Explain the clinical significance of common veterinary methods and treatment (e.g., aseptic techniques, antibiotic use, wound management). | AS.07.01.05.b. Assess the safety and effectiveness of facilities and equipment used for surgical and nonsurgical veterinary treatments and procedures. | AS.07.01.05.c. Identify and describe surgical and nonsurgical veterinary treatments and procedures to meet specific animal health care objectives. |

**MN.AS.07: Animal Anatomy and Physiology, Continued**

Classify, evaluate, and select animals based on anatomical and physiological characteristics.

#### Performance Indicator MN.AS.07.02

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

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.07.02.01.a. Summarize the importance of biosecurity to the animal industry at multiple levels (e.g., local, state, national, global). | AS.07.02.01.b. Analyze procedures at the local, state, and national levels to ensure biosecurity of the animal industry. | AS.07.02.01.c. Design and evaluate a biosecurity plan for an animal production operation. |
| AS.07.02.02.a. Identify and describe zoonotic diseases including their historical significance and potential future implications. | AS.07.02.02.b. Analyze the health risk of different zoonotic diseases to humans and identify prevention methods. | AS.07.02.02.c. Research and evaluate the effectiveness of zoonotic disease prevention methods and procedures to identify those that are best suited to ensure public safety and animal welfare. |

#### Performance Indicator MN.AS.07.03

Demonstrate technical skills through clinical, hospital, and other laboratory procedures (e.g., restraints, injections, bandaging, physical exams).

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.07.03.01.a. Summarize the importance of technical skills and clinical procedures in the veterinary industry. | AS.07.03.01.b. Analyze when the procedures would be utilized in the clinic setting and describe how they would be performed. | AS.07.03.01.c. Demonstrate the clinical procedures performed in the veterinary medicine industry.  |

### MN.AS.08: Environmental Conservation within Animal Systems

Analyze environmental factors associated with animal production.

#### Performance Indicator MN.AS.08.01

Design and implement methods to reduce the effects of animal production on the environment.

| **Introductory Course Benchmarks** | **Intermediate Course Benchmarks** | **Advanced Course Benchmarks** |
| --- | --- | --- |
| AS.08.01.01.a. Identify and summarize the effects of animal agriculture on the environment (e.g., waste disposal, carbon footprint, air quality, environmental efficiencies). | AS.08.01.01.b. Assess the effectiveness of methods of reducing the effects of animal agriculture on the environment. | AS.08.01.01.c. Devise a plan that includes measures to reduce the impact of animal agriculture on the environment. |
| AS.08.01.02.a. Research and summarize environmental conditions that impact animals (e.g., weather, sources of water, food resources). | AS.08.01.02.b. Critique the reliability and validity of evidence presented to support claims regarding the effects of environmental conditions on animal populations and performance (e.g., population changes, emerging species, extinction). | AS.08.01.02.c. Apply valid and reliable research evidence to predict the potential effects of different environmental conditions for an animal population. |
| AS.08.01.03.a. Identify and summarize methods for ensuring optimal environmental conditions for animals. | AS.08.01.03.b. Implement and evaluate the effectiveness of methods to ensure optimal environmental conditions for animals. | AS.08.01.03.c. Devise and improve plans to establish favorable environmental conditions for animal growth and performance based on a variety of factors (e.g., economic feasibility, environmental sustainability, impact on animals). |

### Secondary/Multidisciplinary AFNR Pathways that Align with AS

[Section 8: Agribusiness Systems (ABS)](#_Toc74007518) 135

A secondary or multidisciplinary AFNR pathway, often integrating standards or cumulating from coursework from the AFNR animal, plant, natural resources, and power systems pathways—encompassing the study of agribusinesses and their management including, but not limited to, record keeping, budget management (cash and credit), business planning, and sales and marketing. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the planning, development, application, and management of agribusiness systems in AFNR settings.

[Section 9: Food Products and Processing Systems (FPP)](#_Toc74007518) 151

A secondary or multidisciplinary AFNR pathway—often integrating standards or cumulating from coursework from the AFNR animal and plant systems pathways—encompassing the study of food safety and sanitation; nutrition, biology, microbiology, chemistry, and human behavior in local and global food systems; food selection and processing for storage, distribution, and consumption; and the historical and current development of the food industry. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application, and management of food products and processing systems in AFNR settings.

[Section 10: Biotechnology Systems (BS)](#_Toc74007518) 174

A secondary or multidisciplinary AFNR pathway—often integrating standards or cumulating from coursework from the AFNR animal, plant, and natural resources pathways—encompassing the study of using data and scientific techniques to solve problems concerning living organisms with an emphasis on applications to agriculture, food, and natural resource systems. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application, and management of biotechnology systems in AFNR settings.