CTE Standards Unpacking
Advanced Plant Science

Course: Advanced Plant Science
Course Description: The plant science industry is a large part of the economic structure in South Dakota, especially crop and forage production. Every corner of South Dakota is involved in the plant science field. In Advanced Plant Science, students develop the necessary knowledge, skills, habits and attitudes for both entry-level employment and advancement within agronomy and related plant science occupations. Topics include plant anatomy, physiology, and classification, sustainability in agronomic operations, pest management, and employability skills. Classroom and laboratory content may be enhanced by utilizing appropriate equipment and technology. Algebra, biology, English and human relations skills will be reinforced in the course. Advanced Plant Science is reinforced through the FFA and Supervised Agricultural Experience (SAE) activities such as the Agronomy Career Development Event and related Proficiency Awards. Each student will be expected to maintain a SAE.
Career Cluster: Agriculture, Food and Natural Resources
Prerequisites: Fundamental Plant Science AND/OR Fundamental Horticulture, Recommended: Introduction to AFNR
Program of Study Application: Advanced Plant Science is a second pathway course in the Agriculture, Food and Natural Resources Program of Study, Plant Systems pathway. Advanced Plant Science is preceded by a Fundamental Plant Science and would be followed by Ag Biotechnology.

INDICATOR #ADPS 1: Recognize principles of plant anatomy, classification, and physiology for the production and management of agronomic plants.
SUB-INDICATOR 1.1 (Webb Level: 1 Recall): Classify plants according to taxonomy, life cycles, and plant use.
SUB-INDICATOR 1.2 (Webb Level: 2 Skill/Concept): Compare the benefits and risks of genetically modified plants (GMO).
SUB-INDICATOR 1.3 (Webb Level: 2 Skill/Concept): Apply knowledge of seed, fruit, and vegetative parts optimal for plant reproduction.

Knowledge (Factual):	Understand (Conceptual):	Do (Application):
-Identify range, crop, and horticultural plants	-Understand the difference between major economic crops	-Demonstrate pollination process
-Identify growth zones located in South Dakota.	-Understand the steps in recombinant DNA technology	-Interpret growth zones
-Define dichotomous key		-Use a dichotomous key to classify plants
-Describe the electrophoresis process	-Understand the growth and reproductive stages of plants	-Demonstrate tissue culture (e.g. cuttings, air layering, grafting, etc.)
-Describe germination		

process and conditions		-Perform the electrophoresis process
		-Dissect a seed and have students sketch a design of the parts and describe their function
		-Employ methods of vegetative reproduction.
		-Demonstrate methods of asexual/sexual plant propagation
		-Diagram the process of plant fertilization
		-Sketch the difference between cross pollination and self-pollination plants

Benchmarks:
Students will be assessed on their ability to:
- Create a dichotomous key.
- Present global issues with genetically modified plants.
- Compete in SD FFA Agronomy CDE – Evaluating seeds for germination viability.
- Compete in SD FFA Range Plant ID CDE – Identify the parts of the plant.
- Compete in SD FFA Nursery Landscape CDE – Identify the parts of the plant.
- Utilize Ag Issue CDE and have class put together presentation on the pros and cons of GMO's.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
Science: HS-LS4-3 – Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	-Use Punnett square to predict plant traits.

INDICATOR #ADPS 2: **Employ the principles and practices of sustainable agriculture in a plant-based operation.**

SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Incorporate the fundamentals of plant management and sustainable agriculture.
SUB-INDICATOR 2.2 (Webb Level: 3 Strategic Thinking): Evaluate a fertilizer plan for specific plants or crops.
SUB-INDICATOR 2.3 (Webb Level: 3 Strategic Thinking): Evaluate data to manage range and pastures.
SUB-INDICATOR 2.4 (Webb Level: 3 Strategic Thinking): Examine growth of a plant to determine when and how a crop should be harvested and stored.
SUB-INDICATOR 2.5 (Webb Level: 3 Strategic Thinking): Evaluate crop and harvest success for future planning.

Knowledge (Factual):	Understand (Conceptual):	Do (Application):
-Define sustainable agriculture -Identify variety selection factors -Appraise soil moisture -Identify how drones are used in agriculture -Describe types of grain storage handling facilities and equipment -Define maximum economic yield concepts -Understand the difference between stages of plant growth	-Understand the principles and practices of plant management and sustainable agriculture -Understand the growth stages of plants to determine when and how a crop should be harvested and stored	-Select plant varieties based on maturity factors -Interpret variety test results -Inoculate seed -Evaluate how the addition of chemicals effect soil nutrients -Evaluate plant nutrient requirements and create a fertilizer plan based on soil test results -Evaluate common commercial fertilizer -Evaluate precision agriculture techniques -Utilize GPS and GIS -Examine crop samples for nutrient analysis -Examine a heat map for crop maturity -Research and select a

		grain drying system -Evaluate market grade factors of forages and crops -Select crop rotation system -Analyze a soil test -Analyze a field map with soil test data and determine range site and ecological status -Critique desirable habitat for domestic and wildlife animals or plants -Evaluate a plan for animal rotation and optimum, ecological pasture care

Benchmarks:

Students will be assessed on their ability to:

- Compete in the Range Plant ID Contest.
- Compete in Range Judging Contest
- Calculate livestock carrying capacity.
- Calculate forage and crop harvest loss.
- Calculate combine harvest losses.
- Calculate breakeven and compare breakeven to selling price.
- Calculate the amount of fertilizer necessary to apply.
- Test hay for moisture content.
- Test moisture content of grain.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
Math: HSS.IC.B.4 - Use data from a sample survey to estimate a population mean or proportion.	-Conduct a lab activity where livestock carrying capacity is measured and calculated.

INDICATOR #ADPS 3: **Analyze a pest management system.**		
SUB-INDICATOR 3.1 (Webb Level: 2 Skill/Concept): Identify pest chemicals by formulation and use.		
SUB-INDICATOR 3.2 (Webb Level: 3 Strategic Thinking): Develop integrated pest management strategies to manage pest populations.		
SUB-INDICATOR 3.3 (Webb Level: 2 Skill/Concept): Understand the safe handling, mixing and application of chemicals.		
Knowledge (Factual): -Classify pesticides by purpose -Identify pests that can be controlled with certain chemicals -Identify pests that need to be controlled -Recognize plant disease symptoms -Identify pests that need to be controlled	**Understand (Conceptual):** -Understand integrated pest management -Understand chemical safety in pest management	**Do (Application):** -Solve chemical formulations -Interpret chemical labels -Research noxious weed laws -Compare and contrast biological, chemical and mechanical control of plant pests
Benchmarks: *Students will be assessed on their ability to:* - Calculate forage and crop damage. - Calculate pest control thresholds. - Calculate forage and crop damage. - Calculate pest control thresholds. - Create an Integrated Pest Management Plan.		
Academic Connections		

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
English: 1) 9-12 W.6 – Use technology, including the internet, to produce an individual writing product.	-Research state and national noxious weed laws.
2) 9-12 RI.1 – Interpreting a text explicitly and drawing inferences.	-Observe agronomist's reports and make pest management decisions.

INDICATOR #ADPS 4: **Develop employability skills related to the Plant Systems Pathway.**		
SUB-INDICATOR 4.1 (Webb Level: 2 Skill/Concept): Develop soft skills to enhance employability.		
Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Identify plant science related careers -Recognize non-verbal communication signals -Identify ways to handle conflict	-Understand plant system career pathways -Understand plant system career educational requirements	-Demonstrate proper communication skills -Compose a cover letter, resume, and follow-up letter -Fill out a job application -Complete a job interview
Benchmarks: *Students will be assessed on their ability to:* • Create a SAE project. • Work as a team to solve problems.		
Academic Connections		

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):
English: 1) 9-12 SL.1 - Participate in collaborative discussion	-Complete a job interview with local business representatives.
2) 9-12 W.2 – Write to inform	-Compose a cover letter, resume, and follow-up letter.

Additional Resources
- MyCAERT Curriculum
- Cengage Introduction to Agronomy, Food, Crops, and Environment textbook
- Plant & Soil Science: Fundamentals and Applications by Rick Parker (Delmar Cengage Learning)
- Principles of Agriculture, Food, and Natural Resources by Rayfield, Smith, Park, and Croom (Goodheart-Wilcox Publisher)
- Curriculum for Agricultural Science Education: Principles of Agricultural Science-Plant
- Curriculum for Agricultural Science Education: Animal and Plant Biotechnology
- Unleashing a Decade of Innovation in Plant Science: A Vision for 2015-2025 (www.plantsummit.files.wordpress.com)
- South Dakota Soybean Interactive Curriculum: http://www.vivayicsolutions.com/063-SDSoy&PC/16-01SoyInteractive/Gold/story_html5.html
- Communities of Practice: Horticulture/Greenhouse Management (https://communities.naae.org/community/instruction/horticulture)
- Web Soil Survey