The REACCH Agronomy Curriculum supports the following AFNR Standards, NGSS, & CCSS, however additional resources and time may be required to completely meet the intent of these standards. The following standards align with the 10-Unit REACCH Curriculum:

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| **HS-LS2 Ecosystems: Interactions, Energy, and Dynamics** | | |
| **HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.** [Clarification: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.]  **HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.** [Clarification: Examples of models could include simulations and mathematical models.]  **HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.** [Clarification: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.] | | |
| The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education:* | | |
| **Science and Engineering Practices** | **Disciplinary Core Ideas** | Crosscutting Concepts |
| **Developing and Using Models**  Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show how relationships among variables between systems and their components in the natural and designed worlds.   * Develop a model based on evidence to illustrate the relationships between systems or components of a system.   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.   * Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. * Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoffs.   **-------------------------------------------------------**  ***Connections to Nature of Science*  Scientific Knowledge is Open to Revision in Light of New Evidence**   * Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. | **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems**   * Photosynthesis and cellular respiration provide most of the energy for life processes. * Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.   **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**   * Moreover, anthropogenic changes in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt ecosystems and threaten species survival.   **PS3.D: Energy in Chemical Processes**   * The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.   **ETS1.B: Developing Possible Solutions**   * When evaluating solutions, it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. | **Systems and System Models**   * Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.   **Energy and Matter**   * Energy drives the cycling of matter within and between systems.   **Stability and Change**   * Much of science deals with constructing explanations of how things change and how they remain stable. |
| *Common Core State Standards Connections:*  *ELA/Literacy –*  **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-3)  **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-7)  **RST.9-10.8** Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem. (HS-LS2-7)  **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-7)  **WHST.9-12.5** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)  **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)  *Mathematics –*  **MP.2** Reason abstractly and quantitatively. (HS-LS2-7)  **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-7)  **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-7) | | |

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| **HS-ESS2 Earth’s Systems** | | |
| Students who demonstrate understanding can:  **HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth’s surface can create feedbacks that cause changes to other Earth’s systems.** [Clarification: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth’s surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion.]  **HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.** [Clarification: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.]  **HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.** [Clarification: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide evidence for connections between the hydrologic cycle and system interactions. Examples of mechanical investigations include erosion using variations in soil moisture content or frost wedging by the expansion of water as it freezes.]  **HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.** [Clarification: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.] | | |
| The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education:* | | |
| **Science and Engineering Practices** | **Disciplinary Core Ideas** | Crosscutting Concepts |
| **Developing and Using Models**  Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).   * Develop a model based on evidence to illustrate the relationships between systems or between components of a system. * Use a model to provide mechanistic accounts of phenomena.   **Planning and Carrying Out Investigations**  Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.   * Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.   **Analyzing and Interpreting Data**  Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.   * Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.   **--------------------------------------------------------**  ***Connections to Nature of Science***  **Scientific Knowledge is Based on Empirical Evidence**   * Science arguments are strengthened by multiple lines of evidence supporting a single explanation. | **ESS2.C: The Roles of Water in Earth’s Surface Processes**   * The abundance of liquid water on Earth’s surface and its unique combination of physical and chemical properties are central to the planet’s dynamics. These properties include water’s exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.   **ESS2.D: Weather and Climate**   * The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space. * Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. * Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.   **ESS2.E: Bio-geology**   * The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth’s surface and the life that exists on it. | **Cause and Effect**   * Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.   **Energy and Matter**   * The total amount of energy and matter in closed systems is conserved.   **Structure and Function**   * The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.   **Stability and Change**   * Feedback (negative or positive) can stabilize or destabilize a system.   **----------------------------------------**  **Connections to Engineering, Technology, and Applications of Science**  **Influence of Engineering, Technology, and Science on Society and the Natural World**   * New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. |
| *Common Core State Standards Connections:*  *ELA/Literacy –*  **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS2-2)  **RST.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS2-2)  **WHST.9-12.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-ESS2-5)  **SL.11-12.5** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-4)  *Mathematics –*  **MP.2** Reason abstractly and quantitatively. (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6)  **MP.4** Model with mathematics. (HS-ESS2-4), (HS-ESS2-6)  **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6)  **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-4), (HS-ESS2-6)  **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6) | | |

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| **HS-ESS3 Earth and Human Activity** | | |
| **HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** [Clarification: Examples of key natural resources include access to fresh water, fertile soils, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as soil erosion), and severe weather (such as floods and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]  **HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.** [Clarification: Emphasis is on the conservation, recycling, and reuse of resources and on minimizing impacts. Examples include developing best practices for agricultural soil use.]  **HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.** [Clarification: Examples of factors that affect human sustainability include agricultural efficiency.]  **HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.** [Clarification: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]  **HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.** [Clarification: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).]  **HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.** [Clarification: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] | | |
| The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education:* | | |
| **Science and Engineering Practices** | **Disciplinary Core Ideas** | Crosscutting Concepts |
| **Analyzing and Interpreting Data**  Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.   * Analyze data using computational models in order to make valid and reliable scientific claims.   **Using Mathematics and Computational Thinking**  Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.   * Create a computational model or simulation of a phenomenon, designed device, process, or system. * Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations.   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories.   * Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. * Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.   **Engaging in Argument from Evidence**  Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.   * Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).   **----------------------------------------------**  ***Connections to Nature of Science***  **Scientific Investigations Use a Variety of Methods**   * Science investigations use diverse methods and do not always use the same set of procedures to obtain data. * New technologies advance scientific knowledge.   **Scientific Knowledge is Based on Empirical Evidence**   * Science knowledge is based on empirical evidence. * Science arguments are strengthened by multiple lines of evidence supporting a single explanation. | **ESS2.D: Weather and Climate**   * Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.   **ESS3.A: Natural Resources**   * Resource availability has guided the development of human society. * All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.   **ESS3.B: Natural Hazards**   * Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.   **ESS3.C: Human Impacts on Earth Systems**   * The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. * Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.   **ESS3.D: Global Climate Change**   * Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. * Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.   **ETS1.B: Developing Possible Solutions**   * When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. | **Cause and Effect**   * Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.   **Systems and System Models**   * When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.   **Stability and Change**   * Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. * Feedback (negative or positive) can stabilize or destabilize a system.   **-----------------------------------------------**  **Connections to Engineering, Technology, and Applications of Science**  **Influence of Engineering, Technology, and Science on Society and the Natural World**   * Modern civilization depends on major technological systems. * Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. * New technologies can have deep impacts on society and the environment, including some that were not anticipated. * Analysis of costs and benefits is a critical aspect of decisions about technology.   **----------------------------------------------**  ***Connections to Nature of Science***  **Science is a Human Endeavor**   * Science is a result of human endeavors, imagination, and creativity.   **Science Addresses Questions About the Natural and Material World**   * Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. * Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. * Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. |
| *Common Core State Standards Connections:*  *ELA/Literacy –*  **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-ESS3-5)  **RST.11-12.2** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)  **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5)  **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4)  **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)  *Mathematics –*  **MP.2** Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)  **MP.4** Model with mathematics. (HS-ESS3-3), (HS-ESS3-6)  **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)  **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)  **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6) | | |

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| **HS-ETS1 Engineering and Design** | | |
| **HS-ETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.  **HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.  **HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.  **HS-ETS1-4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. | | |
| The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education:* | | |
| **Science and Engineering Practices** | **Disciplinary Core Ideas** | Crosscutting Concepts |
| **Asking Questions and Defining Problems**  Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.   * Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)   **Using Mathematics and Computational Thinking**  Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.   * Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4)   **Constructing Explanations and Designing Solutions**  Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.   * Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2) * Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3) | **ETS1.A: Defining and Delimiting Engineering Problems**   * Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) * Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)   **ETS1.B: Developing Possible Solutions**   * When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) * Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)   **ETS1.C: Optimizing the Design Solution**   * Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2) | **Systems and System Models**   * Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales. (HS-ETS1-4)   **---------------------------------------------**  **Connections to Engineering, Technology,**  **and Applications of Science**  **Influence of Science, Engineering, and Technology on Society and the Natural World**   * New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HS-ETS1-3) |
| *Common Core State Standards Connections:*  *ELA/Literacy –*  **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3)  **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1), (HS-ETS1-3)  **RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1), (HS-ETS1-3)  *Mathematics –*  **MP.2** Reason abstractly and quantitatively. (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4)  **MP.4** Model with mathematics. (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) | | |

**\*** This performance expectation integrates traditional science content with engineering through a practice or disciplinary core idea.

**Agriculture, Food, and Natural Resources Standards**

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| AS.08. | CCTC Standard: Analyze environmental factors associated with animal production. |
| AS.08.01. | PI: Design and implement methods to reduce the effects of animal production on the environment. |
| CRP.02. | CCTC Standard: Apply appropriate academic and technical skills. |
| CRP.02.01. | PI: Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community. |
| CRP.02.02. | PI: Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community. |
| CRP.04. | CCTC Standard: Communicate clearly, effectively and with reason. |
| CRP.04.01. | PI: Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings. |
| CRP.04.02. | PI: Produce clear, reasoned and coherent written and visual communication in formal and informal settings. |
| CRP.04.03. | PI: Model active listening strategies when interacting with others in formal and informal settings. |
| CRP.05. | CCTC Standard: Consider the environmental, social and economic impacts of decisions. |
| CRP.05.01. | PI: Assess, identify and synthesize the information and resources needed to make decisions that positively impact the workplace and community. |
| CRP.05.02. | PI: Make, defend and evaluate decisions at work and in the community using information about the potential environmental, social and economic impacts. |
| CRP.06. | CCTC Standard: Demonstrate creativity and innovation. |
| CRP.06.01. | PI: Synthesize information, knowledge and experience to generate original ideas and challenge assumptions in the workplace and community. |
| CRP.06.02. | PI: Assess a variety of workplace and community situations to identify ways to add value and improve the efficiency of processes and procedures. |
| CRP.06.03. | PI: Create and execute a plan of action to act upon new ideas and introduce innovations to workplace and community organizations. |
| CRP.07. | CCTC Standard: Employ valid and reliable research strategies. |
| CRP.07.01. | PI: Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community. |
| CRP.07.02. | PI: Evaluate the validity of sources and data used when considering the adoption of new technologies, practices and ideas in the workplace and community. |
| CRP.08. | CCTC Standard: Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.08.01. | PI: Apply reason and logic to evaluate workplace and community situations from multiple perspectives. |
| CRP.08.02. | PI: Investigate, prioritize and select solutions to solve problems in the workplace and community. |
| CRP.08.03. | PI: Establish plans to solve workplace and community problems and execute them with resiliency. |
| CRP.09. | CCTC Standard: Model integrity, ethical leadership and effective management. |
| CRP.09.01. | PI: Model characteristics of ethical and effective leaders in the workplace and community. |
| CRP.09.02. | PI: Implement personal management skills to function effectively and efficiently in the workplace. |
| CRP.09.03. | PI: Demonstrate behaviors that contribute to a positive morale and culture in the workplace and community. |
| CRP.10. | CCTC Standard: Plan education and career path aligned to personal goals. |
| CRP.10.01. | PI: Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences. |
| CRP.10.02. | PI: Examine career advancement requirements and create goals for continuous growth in a chosen career. |
| CRP.10.03. | PI: Develop relationships with and assimilate input and/or advice from experts to plan career and personal goals in a chosen career area. |
| CRP.10.04. | PI: Identify, prepare, update and improve the tools and skills necessary to pursue a chosen career path. |
| CRP.11. | CCTC Standard: Use technology to enhance productivity. |
| CRP.11.01. | PI: Research, select and use new technologies, tools and applications to maximize productivity in the workplace and community. |
| CRP.11.02. | PI: Evaluate personal and organizational risks of technology use and take actions to prevent or minimize risks in the workplace and community. |
| CRP.12. | CCTC Standard: Work productively in teams while using cultural/global competence. |
| CRP.12.01. | PI: Contribute to team-oriented projects and builds consensus to accomplish results using cultural global competence in the workplace and community. |
| CS.01. | CCTC Standard: Analyze how issues, trends, technologies and public policies impact systems in the AFNR Career Cluster. |
| CS.01.01. | PI: Research, examine and discuss issues and trends that impact AFNR systems on local, state, national and global levels. |
| CS.02. | CCTC Standard: Evaluate the nature and scope of the AFNR Career Cluster and the role of AFNR in society and the economy. |
| CS.02.01. | PI: Research and use geographic and economic data to solve problems in AFNR systems. |
| CS.04. | CCTC Standard: Demonstrate stewardship of natural resources in AFNR activities. |
| CS.04.01. | PI: Identify and implement practices to steward natural resources in different AFNR systems. |
| CS.05. | CCTC Standard: Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways. |
| CS.05.01. | PI: Evaluate and implement the steps and requirements to pursue a career opportunity in each of the AFNR career pathways. |
| CS.05.02. | PI: Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest. |
| CS.06. | CCTC Standard: Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources. |
| CS.06.01. | PI: Examine and explain foundational cycles and systems of AFNR. |
| ESS.05. | CCTC Standard: Use tools, equipment, machinery and technology common to tasks in environmental service systems. |
| ESS.05.02. | PI: Perform assessments of environmental conditions using equipment, machinery and technology. |
| NRS.01. | CCTC Standard: Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals. |
| NRS.01.03. | PI: Apply ecological concepts and principles to atmospheric natural resource systems. |
| NRS.01.05. | PI: Apply ecological concepts and principles to terrestrial natural resource systems. |
| NRS.01.06. | PI: Apply ecological concepts and principles to living organisms in natural resource systems. |
| NRS.02. | CCTC Standard: Analyze the interrelationships between natural resources and humans. |
| NRS.02.02. | PI: Assess the impact of human activities on the availability of natural resources. |
| NRS.02.05. | PI: Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources. |
| PS.01. | CCTC Standard: Develop and implement a crop management plan for a given production goal that accounts for environmental factors. |
| PS.01.01. | PI: Determine the influence of environmental factors on plant growth. |
| PS.02. | CCTC Standard: Apply principles of classification, plant anatomy, and plant physiology to plant production and management. |
| PS.02.01. | PI: Classify plants according to taxonomic systems. |
| PS.02.02. | PI: Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems. |
| PS.02.03. | PI: Apply knowledge of plant physiology and energy conversion to plant systems. |
| PS.03. | CCTC Standard: Propagate, culture and harvest plants and plant products based on current industry standards. |
| PS.03.02. | PI: Develop and implement a management plan for plant production. |
| PS.03.03. | PI: Develop and implement a plan for integrated pest management for plant production. |
| PS.03.04. | PI: Apply principles and practices of sustainable agriculture to plant production. |
| PST.05. | CCTC Standard: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems. |
| PST.05.01. | PI: Apply computer and other technologies to solve problems and increase the efficiency of AFNR systems. |
| PST.05.03. | PI: Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems. |