

End of Course Assessment Blueprint

Natural Resources and Ecology

The **End of Course Assessment Blueprint** aligns CASE 4 Learning (CASE) Concepts and Performance Objectives to the National AFNR Content standards and performance indicators developed by the National Council for Agricultural Education (The Council). The concepts and performance objectives listed in this blueprint are assessed in the **Natural Resources and Ecology End-of-Course Assessment**. The assessment is available through **NOCTI**, serving as a CASE partner for third-party delivery. Teachers should use this blueprint to prepare their students for the comprehensive **Natural Resources and Ecology End-of-Course Assessment**.

In the CASE learning model, Concepts are key elements of understanding that students are expected to learn. Concepts are developed by a curriculum committee of content experts comprised of industry representatives, post-secondary educators, and secondary teachers. Performance Objectives are how students will demonstrate their understanding of the concept. All Concepts and Performance Objectives measure student competency of the AFNR Content Standards. The AFNR Content Standards provide state agricultural education leaders and educators with a high-quality, rigorous set of standards to guide what students should know and be able to do after completing a program of study in each of the following AFNR Career Pathways.

- Career Ready Practices (Integrated)
- Foundational Pathway Skills (Integrated)
- Agribusiness Systems
- Animal Systems
- Biotechnology Systems
- Education, Communication, and Leadership
- Environmental Sustainability Systems
- Food Products and Processing Systems
- Natural Resource Systems
- Plant Systems
- Power, Structural, and Technical Systems

DEFINITIONS: Within each pathway, the standards are organized and aligned to the CASE curriculum as follows:

- **Standards** – These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and CASE measurements.
- **Performance Indicators** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.
- **CASE Measurements** – These are CASE Concepts with bulleted Performance Objectives. Students carry out the Performance Objectives to show understanding of the Concept, which indicates attainment of each performance indicator. The beginning CASE measurements require students to remember, understand, identify, explain, and summarize information. The intermediate CASE measurements require students to apply, analyze, compare, distinguish, and examine information and scenarios. The advanced CASE measurements require students to assess, evaluate, justify, improve, and create.

The **Agricultural Power and Technology End-of-Course Assessment** measures student competencies in the AFNR Pathways included in this blueprint. For more information about the National AFNR Content Standards, visit The National Council for Agricultural Education's website at <https://www.thencae.org/afnr-standards>.

ENVIRONMENTAL SUSTAINABILITY SYSTEMS STANDARD

ESS.02. Evaluate the impact of public policies and regulations on environmental service system operations.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
ESS.02.01. Interpret and evaluate the impact of laws, agencies, policies, practices, and consumer preferences affecting environmental service systems.		NRE 9.1 Concept 3 Many organizations influence the protection of species and the environment.	
		• Research federal natural resource agencies and identify primary purposes and responsibilities each agency has regarding water contamination. • Argue the role of federal natural resource agencies in a water contamination scenario.	

ENVIRONMENTAL SUSTAINABILITY SYSTEMS STANDARD

ESS.03. Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry and ecology.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
ESS.03.01. Apply meteorology principles to environmental sustainability systems.		NRE 4.1 Concept 2 Gases found in the atmosphere, such as oxygen and nitrogen, take different forms as they move through a biogeochemical cycle.	NRE 4.1 Concept 3 An essential function of the atmosphere is the natural warming of the surface of the Earth.
		• Compare the movement of oxygen and nitrogen to the water cycle.	• Investigate the air temperature at different levels over 24 hours.
		NRE 4.2 Concept 2 Natural occurring processes and human activity influence air quality.	NRE 4.2 Concept 3 The greenhouse effect theory explains the potential reasons and causes of global warming.
		• Monitor carbon dioxide concentrations in a classroom with different levels of ventilation.	• Simulate the greenhouse effect in a small scale model. • Investigate air quality for the Ecosystem Study.
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
ESS.03.02. Apply soil science and hydrology principles to environmental sustainability systems.	NRE 2.1 Concept 1 Soil formation factors, including climate and parent material, influence soil types and uses.	NRE 2.1 Concept 3 Soil is a natural filter and can collect nutrients and other materials from water.	NRE 2.1 Concept 4 The development, use, and management of soil as a natural resource are related to soil properties.
	• Depict the process of soil formation by drawing a comic strip.	• Compare the permeability and filtration capacity of different soil types.	• Calculate the slope of an area of land. • Classify land according to appropriate use based on slope, erosion factors, and drainage.

	NRE 2.1 Concept 2 Soil texture and structure influence soil properties and usability. • Determine soil texture by feel and ribbon testing. • Describe and sketch the differences in soil structure types.		
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
ESS.03.03. Apply chemistry principles to environmental sustainability systems.	NRE 3.2 Concept 1 The Water Quality Index uses a series of tests, such as temperature, dissolved oxygen, pH, turbidity, and nitrates, to indicate the overall quality of a body of water. • Review water quality tests that determine the temperature, pH, turbidity, dissolved oxygen, total solids, biochemical oxygen demand, phosphates, nitrates, and fecal coliform.	NRE 3.2 Concept 2 Water quality determines potential water uses, such as for drinking, irrigation for agriculture, industrial use, and recreational use. • Calculate the quality of local water by completing the Water Quality Index.	
		NRE 3.2 Concept 3 Environmental conditions and human activities influence water quality. • Determine the ability of different soils to filter acid rain.	

ENVIRONMENTAL SUSTAINABILITY SYSTEMS STANDARD			
ESS.04. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).			
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
ESS.04.01. Develop systems of sustainability management for all categories of solid waste in environmental sustainability systems.	NRE 8.1 Concept 3 Managing waste impacts society and has environmental costs and benefits. • Conduct a school recycling inventory and calculate the reduction in carbon dioxide emissions that result.		

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
ESS.04.02. Sustainably manage solid waste in environmental service systems.		NRE 8.1 Concept 4 Proper waste management is essential for healthy ecosystems. - Investigate the positive and negative impacts of waste on the environment and improve the environmental costs of waste management. - Develop an integrated municipal waste management process to reduce waste for a community.	

NATURAL RESOURCE SYSTEMS STANDARD

NRS.01. Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.01.01. Examine natural resource availability and ecosystem function in a particular region.	NRE 1.1 Concept 3 The perception of conservation, preservation, and exploitation regarding the use of natural resources influence natural resource management decisions. - Record notes and reflections related to the information presented in class regarding conservation, preservation, and exploitation. NRE 1.2 Concept 1 A biome, classified by the predominant vegetation, is primarily determined by climate, altitude, and latitude. - Research a biome and determine the defining characteristics of that biome. - Use multimedia presentation tools to share biome information as a team. NRE 5.1 Concept 1 Energy and nutrients flow through trophic levels within an ecosystem. - Determine the sequence of energy flow of a group of organisms and sketch the food web. - Calculate the percent of energy transfer through the trophic levels of a food chain.	NRE 6.2 Concept 2 Organisms use natural processes to adapt to their environments and increase their chances of survival. Investigate an animal's adaptive nature, such as the beak of a bird to its environment to acquire food for survival.	
PERFORMANCE INDICATOR			

	Beginning	Intermediate	Advanced
NRS.01.02. Classify different types of natural resources in order to enable protection, conservation, enhancement, and management in a particular geographical region.	NRE 6.1 Concept 1 Biodiversity refers to the variety of living components in an ecosystem.		
	Determine the biodiversity of plants in a given area using a common sampling technique.		
	NRE 6.1 Concept 3 Vegetation type present in an ecosystem is influenced by the environment and the activity of animals and humans.		
	Simulate the process of vegetative succession by role playing in a game.		
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.01.03. Apply ecological concepts and principles (e.g., weather, air quality, UV protection, atmospheric pressure, etc.) to the interaction of atmospheric and natural resource systems.	NRE 3.1 Concept 1 Solar energy drives the hydrologic cycle, resulting in water evaporating into the atmosphere and returning to the surface of the Earth in different forms.	NRE 3.1 Concept 2 Water is converted into a series of forms as it moves through the environment over time.	
	Diagram the hydrologic cycle and define terms used in describing the movement of water through the cycle.	Simulate the movement of water through the hydrologic cycle using a model system.	
		NRE 3.1 Concept 3 Lakes, rivers, and oceans are three significant types of bodies of water that have characteristics influenced by climate, topography, and organisms.	
		- Compare aquatic ecosystems and note differences and similarities. - Identify lakes, rivers, and oceans found in North America and research the characteristics of geography, climate, and elevation that influence those bodies of water. - Investigate an aquatic ecosystem and research the defining characteristics of that ecosystem.	
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
			NRE 3.2 Concept 4 The movement of water through watersheds and soil can alter the quality of water.

NRS.01.04. Apply ecological concepts and principles to aquatic natural resource systems.			• Compare Q-Values and Water Quality Indexes at two river locations and analyze the causes of the changes. • Evaluate the water resources and quality of a chosen ecosystem.
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.01.05. Apply ecological concepts and principles to terrestrial natural resource systems.	NRE 6.1 Concept 4 Plant populations shift in response to changes in the environment.	NRE 2.2 Concept 2 Erosion influences land use and may cause environmental changes in ecosystems.	
	• Simulate the process of vegetative succession by role playing in a game.	• Design and conduct an experiment to determine the effects of slope and vegetation on erosion.	
		NRE 7.2 Concept 1 Effective forest management requires identifying goals and proposed uses of the forest, such as aesthetics, recreation, urban values, water, wilderness, wildlife, and wood products.	NRE 7.2 Concept 2 Forest management techniques include timber extraction, planting, and replanting of various species, cutting roads and pathways through forests, and fire management.
		• Determine the value of local trees using the National Tree Benefit calculator. • Calculate board feet of lumber and estimate the economic value of local trees	• Develop a forest management plan summary based on the research of an assigned national forest.
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.01.06. Apply ecological concepts and principles to biotic organisms in natural resource systems.		NRE 5.1 Concept 3 The availability of natural resources determines the carrying capacity of a given species in an ecosystem.	NRE 6.2 Concept 4 Various objectives influence the management of wildlife species.
		• Simulate the carrying capacity of a deer population with access to food, water, and shelter. • Determine the habitat area requirements for a group of animals in an ecosystem and the overall area needed to sustain the ecosystem.	• Conduct hypothetical wildlife management decisions and identify at least four factors that can affect the size of a wildlife population.

NATURAL RESOURCE SYSTEMS STANDARD

NRS.02.01. Analyze the interrelationships between natural resources and humans.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced

NRS.02.02. Assess the impact of human activities on the availability of natural resources.	NRE 8.1 Concept 1 Human populations and their food, fiber, and fuel needs impact the natural environment.		
	Determine their carbon footprint and their family's carbon footprint and consider how to reduce their carbon emission impact on the natural environment.		
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.02.03. Analyze how social perceptions of natural resource management, protection, enhancement, and improvement change and develop over time.	NRE 1.1 Concept 1 Individuals have different perceptions about natural resources and ecology.		
	Survey and determine current thoughts regarding the use and management of natural resources.		
	NRE 8.2 Concept 2 Protected natural spaces, such as National Parks and Scenic areas, have been designated to preserve landmarks as well as native flora and fauna.		
	Research a national park or forest to identify and summarize its history, unique features, and available recreational activities to develop a guide.		
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.02.04. Examine and explain how economics affects the use of natural resources.		NRE 8.1 Concept 2 Energy is available from diverse renewable and nonrenewable sources.	
		Simulate the buying and selling of energy units from a diverse group of energy producers and discuss how energy prices affect the average consumer.	

NATURAL RESOURCE SYSTEMS STANDARD			
NRS.03. Develop plans to ensure sustainable production and processing of natural resources.			
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.03.01. Sustainably produce, harvest, process, and use natural	NRE 7.3 Concept 1 Essential mineral resources are available due to many different practices and methods.	NRE 7.3 Concept 2 Natural resource mining has positive and negative impacts	NRE 8.2 Concept 3 Recreational use of natural resource areas requires the development of skills to ensure the

resource products (e.g., forest and rangeland products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).		on the environment and human populations.	individual's safety while protecting the integrity of the natural resource.
	• Synthesize and connect to the different mining practices and methods used to mine significant mineral resources through a mining simulation. • Investigate the process of enhanced oil recovery while considering the resources used to recover the oil. • Investigate methods for cleaning up oil spills. • Design and test an oil-water separator.	• Consider the impact mining has on the environment and natural resources and determine mining practices to protect the environment. • Characterize the effects of oil spills on ecosystems and humans. • Evaluate the human uses of land and resources for a chosen ecosystem.	• Investigate and plan an outdoor experience that incorporates personal interests yet leaving the smallest footprint to protect natural resources.
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.03.02. Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing and evaluating natural resource management plans.	NRE 2.2 Concept 1 Topographic maps provide information on the configuration of the surface of the Earth.		
	• Read a topographic map and understand the steepness of the slope portrayed on the map.		•

NATURAL RESOURCE SYSTEMS STANDARD

NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
NRS.04.01. Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.		NRE 6.2 Concept 1 Wildlife requires habitat, including food, water, shelter, and space, suited to their needs to thrive in a community.	NRE 6.2 Concept 5 Wildlife management includes improving habitat for a focal species.
		• Research the habitat requirements of an animal and write a description of those needs to match an animal with its proper habitat.	• Select a focal species in the ecosystem study and make a habitat management plan for that animal.

PLANT SYSTEMS STANDARD

PS.03. Propagate, culture and harvest plants and plant products based on current industry standards.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PS.03.04. Apply principles and practices of sustainable agriculture to plant production.			NRE 7.1 Concept 2 Agricultural stewardship balances agriculture productivity and profitability while conserving natural resources. • Apply skills and knowledge learned regarding stewardship and sustainable agriculture management decisions related to a fictitious property, determine a commodity to raise, apply for a stewardship program, and choose the best stewardship practices to implement.