

TENNESSEE/METRO NASHVILLE PUBLIC SCHOOLS ACADEMIC STANDARDS/SCIENCE – ECOLOGY

ECOLOGY: EMBEDDED INQUIRY

Conceptual Strand - Inquiry <i>Understanding about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.</i>		Guiding Question - Inquiry <i>What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.Inq.1 Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.</p> <p>CLE 3255.Inq.2 Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories.</p> <p>CLE 3255.Inq.3 Use appropriate tools and technology to collect precise and accurate data.</p> <p>CLE 3255.Inq.4 Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.</p> <p>CLE 3255.Inq.5 Compare experimental evidence and conclusions with those drawn by others about the same testable question.</p> <p>CLE 3255.Inq.6 Communicate and defend scientific findings.</p>	<p>3255.Inq.1 Develop a testable question for a scientific investigation.</p> <p>3255.Inq.2 Develop an experimental design for testing a hypothesis.</p> <p>3255.Inq.3 Select appropriate independent, dependent, or controlled variables for an experiment.</p> <p>3255.Inq.4 Perform an experiment to test a prediction.</p> <p>3255.Inq.5 Gather, organize, and transform data from an experiment.</p> <p>3255.Inq.6 Analyze and interpret the results of an experiment.</p> <p>3255.Inq.7 Use knowledge and data-interpretation skills to support a conclusion.</p> <p>3255.Inq.8 State a conclusion in terms of the relationship between two or more variables.</p> <p>3255.Inq.9 Compare the results of an experiment with what is already known about the topic under investigation.</p> <p>3255.Inq.10 Suggest alternative explanations for the same observations.</p> <p>3255.Inq.11 Analyze experimental results and identify the nature and sources of experimental error.</p> <p>3255.Inq.12 Formulate and revise scientific explanations and models using logic and evidence.</p> <p>3255.Inq.13 Develop a logical argument about cause-and-effect relationships in an experiment.</p>	

EMBEDDED TECHNOLOGY & ENGINEERING

Conceptual Strand <i>Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.</i>		Guiding Question <i>How do science concepts, engineering skills, and applications of technology improve the quality of life?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.T/E.1 Explore the impact of technology on social, political, and economic systems.</p> <p>CLE 3255.T/E.2 Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying, and retesting.</p> <p>CLE 3255.T/E.3 Explain the relationship between the properties of a material and the use of the material in the application of a technology.</p> <p>CLE 3255.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems.</p>	<p>3255. T/E.1 Select appropriate tools to conduct a scientific inquiry.</p> <p>3255. T/E.2 Apply the engineering design process to construct a prototype that meets developmentally appropriate specifications.</p> <p>3255. T/E.3 Explore how the unintended consequences of new technologies can impact human and non-human communities.</p> <p>3255. T/E.4 Present research on current bioengineering technologies that advance health and contribute to improvements in our daily lives.</p> <p>3255. T/E.5 Design a series of multi-view drawings that can be used by other students to construct an adaptive design and test its effectiveness.</p>	

STANDARD 1 – INDIVIDUALS

Conceptual Strand 1 <i>The individual organism is the basic unit of ecology.</i>		Guiding Question 1 <i>What determines the survival of individuals in a population?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.1.1 Analyze strategies for classifying organisms.</p> <p>CLE 3255.1.2 Identify organisms based on how they obtain energy.</p> <p>CLE 3255.1.3 Relate specific animal behaviors and plant tropisms to survival.</p> <p>CLE 3255.1.4 Investigate various approaches to maintain biodiversity.</p>	<p>3255.1.1 Develop a visual aid to illustrate the major characteristics of the six kingdoms.</p> <p>3255.1.2 Use a dichotomous key to identify at least five species found in a local ecosystem.</p> <p>3255.1.3 Distinguish among primary, secondary and tertiary consumers.</p> <p>3255.1.4 Distinguish among herbivores, carnivores, and omnivores.</p> <p>3255.1.5 Distinguish between photosynthesis and chemosynthesis and describe organisms that occupy these niches in both terrestrial and aquatic habitats.</p> <p>3255.1.6 Investigate animal behavior by observing common invertebrates: termites, isopods, mealworms or bess beetles.</p> <p>3255.1.7 Using simple materials create a living display of photo-, hydro- and geo- tropisms.</p> <p>3255.1.8 Investigate techniques and findings of the All Taxa Biodiversity Inventories (ATBI) underway in the Great Smoky Mountains National Park and Tennessee State Parks.</p> <p>3255.1.9 Explore careers in conservation biology and bioinformatics.</p>	

STANDARD 2— POPULATIONS

Conceptual Strand 2 <i>A population is composed of a single species within a specified area.</i>		Guiding Question 2 <i>What are some characteristics of populations?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.2.1 Cite examples of populations limited by natural factors, humans or both.</p> <p>CLE 3255.2.2 Explain population growth patterns and rates.</p> <p>CLE 3255.2.3 Summarize how natural selection influences a population over time.</p>	<p>3255.2.1 Define population and describe several examples of populations in different ecosystems.</p> <p>3255.2.2 Identify distribution patterns (random, uniform, clumped with groups random) and populations that exhibit each of these patterns.</p> <p>3255.2.3 Using a population of yeast, duckweed or other suitable species, design and conduct an experiment to evaluate population growth and carrying capacity.</p> <p>3255.2.4 Categorize limiting factors as density dependent or density independent, human influenced or non-human influenced, and biotic or abiotic when given scenarios.</p> <p>3255.2.5 Evaluate populations based on age structure, distribution, and density.</p> <p>3255.2.6 Draw and/or label population growth curves representing exponential growth, logistic growth and carrying capacity.</p> <p>3255.2.7 Illustrate the type of survivorship curves created by r-strategists and K-strategists.</p> <p>3255.2.8 Research case studies (Tasmanian sheep, St. Matthew’s Island reindeer, Isle Royale) to illustrate the consequences of logistic and exponential growth.</p> <p>3255.2.9 Compare case studies of evolution such as Galapagos finches, peppered moths, and salamanders in the Smoky Mountains.</p>	

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STANDARD 3—COMMUNITIES

Conceptual Strand 3 <i>Communities are groups of interacting populations.</i>		Guiding Question 3 <i>How do populations interact to produce stable communities?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.3.1 Explain ecological niches within various habitats.</p> <p>CLE 3255.3.2 Relate species interactions such as competition, predation and symbiosis to coevolution.</p> <p>CLE 3255.3.3 Apply the first and second laws of thermodynamics to explain the flow of energy through a food chain or web.</p> <p>CLE 3255.3.4 Analyze how biomass is related to trophic levels.</p>	<p>3255.3.1 Describe the difference between a fundamental niche and a realized niche.</p> <p>3255.3.2 Create a chart to compare and contrast specialist and generalist species and describe environmental conditions that favor these two approaches.</p> <p>3255.3.3 Distinguish among the following roles and cite Tennessee examples of each: native species, non-native species, invasive species, indicator species, “keystone” species.</p> <p>3255.3.4 Discuss how competition and predation regulate population size.</p> <p>3255.3.5 Summarize the principles of competitive exclusion and resource partitioning.</p> <p>3255.3.6 Distinguish among the three forms of symbiotic relationships.</p> <p>3255.3.7 Describe structural and behavioral adaptations for survival used by predators and prey.</p> <p>3255.3.8 Explain energy pyramids and the “Rule of 10” as they relate to the first and second laws of thermodynamics.</p> <p>3255.3.9 Create a food web characteristic of a Tennessee ecoregion composed of at least four trophic levels.</p>	

STANDARD 4—ECOSYSTEMS

Conceptual Strand 4 <i>An ecosystem is a community that interacts with the physical environment.</i>		Guiding Question 4 <i>How do ecosystems change over time?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.4.1 Describe the flow of energy flow through an ecosystem.</p> <p>CLE 3255.4.2 Describe how matter cycles through various biogeochemical cycles.</p> <p>CLE 3255.4.3 Evaluate the process of succession.</p> <p>CLE 3255.4.4 Summarize the human impact on ecosystems.</p> <p>CLE 3255.4.5 Describe how biodiversity relates to stability of an ecosystem.</p>	<p>3255.4.1 Trace energy flow from the sun through living organisms.</p> <p>3255.4.2 Illustrate each of the following biogeochemical cycles: water, carbon, nitrogen, and phosphorus.</p> <p>3255.4.3 Distinguish between primary and secondary biological succession.</p> <p>3255.4.4 Explore a local area and examine the abiotic and biotic factors relating to succession and ecosystem structure.</p> <p>3255.4.5 Summarize how disturbance contributes to succession and ecosystem stability.</p> <p>3255.4.6 Identify how nutrient availability affects terrestrial and aquatic ecosystems.</p> <p>3255.4.7 Design an ecosystem in the classroom (terrarium, bottle biology, eco-column, etc.) for making observations, conducting experiments and long-term monitoring.</p> <p>3255.4.8 Create a concept map relating the events that lead to the parachuting of cats on Borneo by the World Health Organization.</p>	

STANDARD 5—BIOMES

Conceptual Strand 5 <i>A biome is a region of the earth with characteristic types of natural ecological communities.</i>		Guiding Question 5 <i>How are earth’s biomes distributed?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.5.1 Explain how climate influences terrestrial biomes.</p> <p>CLE 3255.5.2 Compare and contrast the major terrestrial biomes: deserts, temperate grasslands, temperate forests, tropical grasslands, tropical forests, taiga and tundra.</p> <p>CLE 3255.5.3 Examine the major marine and freshwater biomes.</p> <p>CLE 3255.5.4 Infer how organisms in different biomes occupy similar niches.</p> <p>CLE 3255.5.5 Identify how humans impact biomes.</p>	<p>3255.5.1 Illustrate how temperature, precipitation, latitude, and altitude influence terrestrial biomes.</p> <p>3255.5.2 Research and create a visual to summarize the climate, soil, location, plant adaptations, animal adaptations, and human threats to each of the major terrestrial biomes.</p> <p>3255.5.3 Research and create a visual to summarize abiotic factors, location, plant adaptations, animal adaptations, and human threats to marine and freshwater biomes.</p> <p>3255.5.4 Research wetlands in your area and write a persuasive letter to a public official concerning the protection of wetlands.</p> <p>3255.5.5 Compare two or more ecological equivalents and how they are specifically adapted to their particular biome (black/grizzly bears, Asian/African elephants, snowshoe/cottontail/jack rabbit).</p>	

STANDARD 6—HUMANS AND SUSTAINABILITY

Conceptual Strand 6 <i>Human activities have reduced the earth’s biodiversity .</i>		Guiding Question 6 <i>What can individuals do to sustain biodiversity locally and globally?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3255.6.1 Investigate the role of public lands in sustaining biodiversity.</p> <p>CLE 3255.6.2 Examine state, national, and international efforts to sustain native species and ecosystems.</p> <p>CLE 3255.6.3 Evaluate the impact of personal actions on the environment.</p> <p>CLE 3255.6.4 Identify and explain choices you can make to lessen your impact on the environment.</p>	<p>3255.6.1 Differentiate the purposes of State and National Parks, Wildlife Refuges, and Forests.</p> <p>3255.6.2 Design a vacation brochure, poster, slide show presentation or commercial advertisement that extols the virtues of a given area (e.g., state or national parks/forests) and ecotourism opportunities that may be found there.</p> <p>3255.6.3 Research and paraphrase local, national, and international environmental legislation enacted to sustain biodiversity (e.g., The Lacey Act, Endangered Species Act, National Marine Fisheries Act, TWRA Hunting and Fishing Regulations, CITES).</p> <p>3255.6.4 Develop a timeline that illustrates major local, national and international environmental legislation enacted to sustain biodiversity.</p> <p>3255.6.5 Find out what watershed your school is located in and how wastewater, municipal solid, and hazardous wastes are handled.</p> <p>3255.6.6 Research issues surrounding the adoption of environmentally and socially responsible behaviors (e.g., proper waste disposal, using fuel efficient transportation, planting native species, purchasing locally grown food, reducing/eliminating dependence on ‘one use’ products).</p> <p>3255.6.7 Create a list of the “Five Biggest Threats to the Global Environment.”</p>	