Virginia Science

Biology II Ecology

The student will demonstrate an understanding of scientific skills and processes by: EC.1

a asking questions and defining problems EC.1.A

- i ask questions that arise from careful observation of phenomena and/or organisms or from examining models and theories, or unexpected results, and/or to seek additional information EC.1.A.I
- ii determine which questions can be investigated within the scope of the school laboratory or field to determine relationships between independent and dependent variables EC.1.A.II
- iii make hypotheses that specify what happens to a dependent variable when an independent variable is manipulated EC.1.A.III

b planning and carrying out investigations EC.1.B

- i individually and collaboratively plan and conduct observational and experimental investigations EC.1.B.I
- ii plan and conduct investigations or test design solutions in a safe and ethical manner including considerations of environmental, social, and personal impacts EC.1.B.II
- iii determine appropriate sample size and techniques EC.1.B.III
- iv select and use appropriate tools and technology to collect, record, analyze, and evaluate data EC.1.B.IV

c interpreting, analyzing, and evaluating data EC.1.C

- i construct and interpret data tables showing independent and dependent variables, repeated trials, and means EC.1.C.I
- ii construct, analyze, and interpret graphical displays of data, including scatterplots and line plots and consider limitations of data analysis EC.1.C.II
- iii apply mathematical concepts and processes to scientific questions EC.1.C.III
- iv use data in building and revising models, supporting explanation for phenomena, or testing solutions to problems EC.1.C.IV
- v analyze data using tools, technologies, and/or models to make valid and reliable scientific claims or determine an optimal design solution EC.1.C.V

d constructing and critiquing conclusions and explanations EC.1.D

- i make quantitative and/or qualitative claims regarding the relationship between dependent and independent variables EC.1.D.I
- ii construct and revise explanations based on valid and reliable evidence obtained from a variety of sources including students' own investigations, models, theories, simulations, peer review EC.I.D.II
- iii apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and design solutions EC.1.D.III
- iv compare and evaluate competing arguments or design solutions in light of currently accepted explanations and new scientific evidence EC.1.D.IV
- v construct arguments or counter arguments based on data and evidence EC.1.D.V
- vi differentiate between a scientific hypothesis and theory EC.1.D.VI

e developing and using models EC.1.E

- i evaluate the merits and limitations of models EC.1.E.I
- ii develop, revise, and/or use models based on evidence to illustrate or predict relationships EC.1.E.II
- iii develop and/or use models to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems EC.1.E.III

f obtaining, evaluating, and communicating information EC.1.F

- i compare, integrate, and evaluate sources of information presented in different media or formats to address a scientific question or solve a problem EC.1.F.I
- ii gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and credibility of each source EC.1.F.II
- iii communicate scientific and/or technical information about phenomena in multiple formats EC.1.F.III

The student will investigate and understand that Life History Theory allows for the prediction of an organism's development and behaviors. Key concepts include: EC.2

a Explain how the Life History Theory predicts an organism's potential development and interactions EC.2.A

b Describe the characteristics that make up an organism's life history EC.2.B

c Investigate differences in development among different groups of organisms EC.2.C

d Compare and contrast K-selection and R-selection EC.2.D

e Predict how an organism would grow, develop, and reproduce based on its life history EC.2.E

f Investigate differences in animal behavior (such as taxis v. kinesis) EC.2.F

The student will understand that the individual is the basic unit of ecology. Key ideas include: EC.3	**a** classification is based on molecular phylogenetics, structural, and biochemical characteristics EC.3.A **b** organisms can be classified based on how they use energy EC.3.B **c** systemics, the science of grouping and categorizing organisms, is adaptable to new scientific discoveries EC.3.C
The student will investigate and understand that plants have evolved a variety of adaptations to survive, grow, and reproduce in the wide range of environmental conditions on Earth. Key environmental conditions include: EC.4	**a** quantities of reactants for photosynthesis EC.4.A **b** temperature EC.4.B **c** nutrient availability EC.4.C **d** predators EC.4.D **e** natural selection EC.4.E **f** adaptations EC.4.F **g** environmental relationships EC.4.G
The student will investigate and understand that animals have evolved a variety of adaptations to survive, grow, and reproduce in the diversity of environments existing on earth. Adaptions include: EC.5	**a** body size EC.5.A **b** acquiring and digesting food EC.5.B **c** oxygen absorption EC.5.C **d** maintaining temperature and water balance EC.5.D **e** variations to light and temperature EC.5.E
The student will investigate and understand that different factors influence population density, dispersion, and demographics and use models as predictors of population growth. Key concepts include: EC.6	**a** basic structure of ecological populations includes population distribution and population abundance; EC.6.A **b** factors that regulate population growth include intraspecific competition in population growth and population density; EC.6.B **c** limits to population growth include limiting factors, population density, and carrying capacity; EC.6.C **d** population growth can be described as geometric or exponential; EC.6.D **e** models are used to predict population growth EC.6.E **f** the impact of rapid growth of human population is a source of environmental problems. EC.6.F

The student will investigate and understand that intraspecific interactions and natural selection have an impact on a population. Key ideas include: EC.7	**a** **there is intraspecific and interspecific competition** EC.7.A **b** **organisms have symbiotic relationships** EC.7.B
The student will explore and analyze community structures and interactions. Key concepts include: EC.8	**a** **species interactions (e.g. predation, parasitism, mutualism, commensalism, and competition) and adaptations have evolved in response to interspecific selective pressures;** EC.8.A **b** **ecological niches and resource partitioning impact interactions** EC.8.B **c** **dominant, keystone, foundation, and endangered species have roles in ecosystems and communities, locally and globally;** EC.8.C **d** **species diversity relates to the stability of ecosystems and communities** EC.8.D **e** **ecological succession changes communities over time and may have an impact of disturbance on community composition** EC.8.D
The student will understand the energy flow through an ecosystem. Key concepts include: EC.9	**a** **food chains, webs, and pyramids model energy flow in ecosystems** EC.9.A **b.** **primary productivity is important in ecosystems** EC.9.B **c** **efficiency of energy use is important** EC.9.C **d** **thermodynamic principles apply in an ecological system** EC.9.D **e** **the stability of an ecosystem is related to the biodiversity** EC.9.E
The student will investigate and understand that dead organic matter is crucial to the internal cycling of nutrients in an ecosystem. Key concepts include: EC.10	**a** **climate impacts the type of decomposers in an ecosystem** EC.10.A **b** **rate of decomposition varies by organism and climate** EC.10.B
The student will investigate and understand the effect of human influence on an ecosystem. Key concepts include: EC.11	**a** **Humans influence the pattern of natural changes such as primary/secondary succession and desertification** EC.11.A

The student will analyze how biotic and abiotic factors interact to affect the distribution of species and the diversity of life on Earth. Key concepts include: EC.12	a	**the biotic and abiotic components that define various biomes and aquatic life zones** EC.12.A
	b	**global climate patterns and biogeography impact diversity** EC.12.B
	c	**different factors lead to the species richness of an ecosystem and the importance of biodiversity** EC.12.C
	d	**natural selection has a role in organismal adaptations that are specific to their habitats** EC.12.D
Students will assess the impact of human activities on the natural world, and research how ecological theory can address current issues facing our society, both locally and globally. Key issues include: EC.13	a	**major primary and secondary pollutants** EC.13.A
	b	**sustainable and unsustainable use of resources, including soil, timber, fish and wild game, mineral resources, and nonrenewable energy;** EC.13.B
	c	**natural and anthropogenic climate change** EC.13.C
	d	**habitat fragmentation and habitat loss on biodiversity in relation to island biogeography, and apply island biogeography theory to the design of parks and nature preserves; and** EC.13.D
	e	**the ecological impact of agriculture (historical and modern) in the environment and its implications for feeding the world's population.** EC.13.E