

Norton City Schools Standards-Based Science Course of Study 2003

HIGH SCHOOL ELECTIVE

ENVIRONMENTAL SCIENCE (DEVELOPED SPECIFICALLY FOR NORTON HIGH SCHOOL, USED AS A YEAR-LONG COURSE)

Life Sciences Standard (LS)

Earth and Space Sciences Standard (ES)

11-12 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 11-12 program, the student will:</p> <p><u>Life Sciences</u></p> <ul style="list-style-type: none"> ★ Explain how humans are connected to and impact natural systems. (LS-B) ★ Relate how biotic and abiotic global changes have occurred in the past and will continue to do so in the future. (LS-D) ★ Explain the interconnectedness of the components of a natural system. (LS-E) ★ Explain how human choices today will affect the quality and quantity of life on earth. (LS-F) ★ Summarize the historical development of scientific theories and ideas within the study of life sciences. (LS-G) 	<p>By the end of Eleventh/Twelfth Grades, the student will:</p> <p><u>Characteristics and Structure of Life</u></p> <ul style="list-style-type: none"> ★ Describe how the maintenance of a relatively stable internal environment is required for the continuation of life, and explain how stability is challenged by changing physical, chemical and environmental conditions as well as the presence of pathogens. (LS-11-1) ★ Relate how birth rates, fertility rates and death rates are affected by various environmental factors. (LS-11-3) ★ Examine the contributing factors of human population growth that impact natural systems such as levels of education, children in the labor force, education and employment of women, infant mortality rates, costs of raising children, birth control methods, and cultural norms. (LS-11-4) ★ Investigate the impact on the structure and stability of ecosystems due to changes in their biotic and abiotic components as a result of human activity. (LS-11-5) ★ Explain that the sun is essentially the primary source of energy for life. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. (LS-12-3) 	

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<p><u>Earth and Space Sciences</u></p> <ul style="list-style-type: none">★ Describe how Earth is made up of a series of interconnected systems and how a change in one system affects other systems. (ES-B)★ Explain that humans are an integral part of the Earth's system and the choices humans make today impact natural systems in the future. (ES-C)★ Summarize the historical development of scientific theories and ideas and describe emerging issues in the study of Earth and space sciences. (ES-D)	<p><u>Diversity and Interdependence of Life</u></p> <ul style="list-style-type: none">★ Predict some possible impacts on an ecosystem with the introduction of a non-native species. (LS-11-6)★ Show how populations can increase through linear or exponential growth with corresponding effects on resource use and environmental pollution. (LS-11-7)★ Recognize that populations can reach or temporarily exceed the carrying capacity of a given environment. Show that the limitation is not just the availability of space but the number of organisms in relation to resources and the capacity of earth systems to support life. (LS-11-8)★ Give examples of how human activity can accelerate rates of natural change and can have unforeseen consequences. (LS-11-9)★ Investigate issues of environmental quality at local, regional, national and global levels such as population growth, resource use, population distribution, over-consumption, the capacity of technology to solve problems, poverty, the role of economics, politics and different ways humans view the earth. (LS-11-11)★ Based on the structure and stability of ecosystems and their nonliving components, predict the biotic and abiotic changes in such systems when disturbed (e.g., introduction of non-native species, climatic change, etc.). (LS-12-8) <p><u>Evolutionary Theory</u></p> <ul style="list-style-type: none">★ Recognize that ecosystems change when significant climate changes occur or when one or more new species appear as a result of immigration or speciation. (LS-11-12) <p><u>Historical Perspectives and Scientific Revolutions</u></p> <ul style="list-style-type: none">★ Describe advances in life sciences that have important, long-lasting effects on science and society (e.g., biotechnology). (LS-12-12) <p><u>Earth Systems</u></p> <ul style="list-style-type: none">★ Describe the normal adjustments of Earth, which may be hazardous for humans. Recognize that humans live at the interface between the atmosphere driven by solar energy and the upper mantle where convection creates changes in Earth's solid crust. Realize that as societies have grown, become stable and come to value aspects of the	
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	<p>environment, vulnerability to natural processes of change has increased. (ES-11-8)</p> <ul style="list-style-type: none">★ Explain the effects of biomass and human activity on climate (e.g., climatic change and global warming). (ES-11-9)★ Analyze how materials from human societies (e.g., radioactive waste and air pollution) affect both physical and chemical cycles of Earth. (ES-11-11)★ Explain ways in which humans have had a major effect on other species (e.g., the influence of humans on other organisms occurs through land use, which decreases space available to other species and pollution, which changes the chemical composition of air, soil and water). (ES-11-12)★ Explain how human behavior affects the basic processes of natural ecosystems and the quality of the atmosphere, hydrosphere and lithosphere. (ES-11-13)★ Conclude that Earth has finite resources and explain that humans deplete some resources faster than they can be renewed. (ES-11-14)★ Describe how scientists estimate how much of a given resource is available on Earth. (ES-12-6) <p><u>Historical Perspectives and Scientific Revolutions</u></p> <ul style="list-style-type: none">★ Use historical examples to show how new ideas are limited by the context in which they are conceived; are often rejected by the social establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., global warming, Heliocentric Theory and Theory of Continental Drift). (ES-11-15)★ Describe advances in Earth and space science that have important long-lasting effects on science and society (e.g., global warming, Heliocentric Theory and Plate Tectonics Theory). (ES-11-16) <p><u>Sub-Objectives to Meet Indicators:</u></p> <p>Interdependence of the Earth's Systems</p> <ul style="list-style-type: none">• Compare and contrast the forms of energy (electrical, thermal, chemical, nuclear, and mechanical).• Explain the transformation and conservation of the various forms of energy.	
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- Trace the cyclic movement and recycling of materials in an ecosystem, including carbon, oxygen, and major nutrients, such as nitrogen and phosphates.
 - Compare and contrast the cycling of major and trace elements.
 - Explain the theory of plate tectonics.
 - Explain how various types of soil are formed.
 - Describe the origin, evolution, composition, and structure of the atmosphere.
 - Differentiate between weather and climate.
 - Infer the influences on weather and climate (e.g., atmospheric, various landforms, etc.).
 - Investigate the effects of volcanoes on climate.
 - Distinguish among biomes by describing major biotic and abiotic factors.
 - Describe limiting factors of ecosystems.
 - Label organisms as producers, consumers, and/or decomposers.
 - Graph how populations grow exponentially.
 - Examine and draw a predator-prey response lag graph.
 - Compare and contrast physical and behavioral adaptations that organisms have in order to survive.
 - Examine differences in generalists and specialists populations.
 - Distinguish between types of symbiotic relationships (i.e., predator-prey, mutualism, parasitism, and commensalism).
 - Construct ecological pyramids and describe how energy is transferred and conserved through the trophic levels of an ecosystem.
 - List and explain geographical barriers and their importance to populations.
 - Interpret topographic maps to identify stream systems and watersheds.
 - Explain biomass, productivity and carrying capacity.
 - Describe changes that take place in an ideal succession to a climax.
 - Explain the concept of biological magnification with true-to-life examples.
 - Research the most popular evolutionary theories regarding the natural selection and extinction.
- Human Population Dynamics**
- Describe stages in population growth and decline.
 - Recognize relationships among demographic trends, birth rates, death

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rates, survival curves, and local, regional, and global carrying capacities of populations.

- Identify problems associated with human population growth (e.g., urban sprawl, transportation, resource utilization, heat islands, etc.).
- Research cultural and economic influences on human population dynamics.

Renewable and Nonrenewable Resources

- Compare and contrast the distribution, ownership, use, and degradation of the following renewable and nonrenewable resources:
 - Water
 - Minerals
 - Soil and Land
 - Biological Resources
 - Energy
- Describe the agricultural, industrial, and domestic use of fresh water.
- Explain the importance of ocean (salt) water for fisheries and industrial use.
- Identify mineral samples using diagnostic techniques and a key.
- Compare and contrast various soil types and profiles.
- Predict the cause and effect of eroding agents (e.g., mining, farming, construction, etc.) and propose methods for controlling erosion.
- Identify examples of biological resources, including natural areas, genetic diversity, and food and other agricultural products.
- Compare and contrast energy sources (solar, wind, biomass, propane, natural gas, petroleum, hydropower, nuclear, geothermal, coal).
- Compare and contrast coal, petroleum, and propane as the fossil fuels that are used to produce energy.
- Determine which energy sources are conventional and which are alternative.
- Describe the benefits and hazards associated with each energy source.
- Examine the cost efficiency of using energy sources for practical purposes.
- Investigate the availability and use of renewable and nonrenewable resources.
- Differentiate between renewable and nonrenewable resources and strategies for managing and conserving them.

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	<p>Environmental Quality</p> <ul style="list-style-type: none">• Identify major sources of air, water, and soil pollution, such as sulfur dioxide, nitrates, and pesticides.• Explain thermal pollution.• Collect qualitative measurements of lab solutions and substrates gathered from field research.• Distinguish between point and nonpoint sources of pollution.• Identify examples of domestic, industrial, and agricultural point and nonpoint sources of pollution.• Explain how both individuals and industries pollute.• Describe effects of pollutants on aquatic systems, vegetation, natural features, buildings and other manmade structures, and wildlife.• Formulate plans for pollution reduction, control, and remediation.• Describe solid waste management in terms of types, sources, and amounts.• Research current methods of solid waste disposal and discuss their limitations, especially regarding landfills.• Compare and contrast strengths and drawbacks to alternative practices for solid waste management (e.g., incineration, recycling, etc.)• Research ecological issues to develop a position on problems (e.g., water pollution and its cost, urban sprawl, zebra mussels in the Great Lakes, etc.).	
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