OXFORD HIGH SCHOOL SCIENCE DEPARTMENT

FIELD BIOLOGY CURRICULUM

#361 Field Biology (A) (11-12) One Semester 0.5 Credit

This course is designed to be a hands-on inquiry-based exploration of field and environmental studies. Always focused on making the connections between science and technology and their impact on the quality of our lives, field study uses multiple pathways of scientific reasoning, specifically focused on case studies to understand the interrelationships of the natural world. Students will identify and analyze environmental problems, both natural and man-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions to resolving and/or preventing them. The prerequisite for this course is Biology.

ENDURING UNDERSTANDINGS (BROAD IDEAS, USUALLY GROUNDED IN THE DISCIPLINE):

Science is a creative endeavor that uses logical, analytical processes.

SCIENTIFIC INQUIRY

- Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.
- Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.
- Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists

SCIENTIFIC LITERACY

- Scientific literacy includes the ability to read, write, discuss and present coherent ideas about science.
- Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

SCIENTIFIC NUMERACY

- Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

COURSE SPECIFIC GOALS (ALIGNED WITH CONTENT STANDARDS):

ECOLOGICAL BALANCE – The opposing forces within an environment whether naturally occurring or man-made are being kept balanced with one another, which can be determined through the use field data collection and analysis.

BIODIVERSITY – The variety of organisms present within a particular ecological community, which can be measured by the numbers and types of different species.

AQUATIC HABITATS – The aquatic environment is composed of physical, chemical and biological parameters which provide numerous opportunities for data collection and analysis. These measurements permit the comparison to similar aquatic habitats with comparable parameters in geographic proximity. This analysis permits us to determine the overall quality of a site.

HUMAN ACTIVITY – The various daily routines carried out by humans have measureable impacts upon the surrounding environment. *Pinus strobes*, a bioindicator species, provides quantifiable method for assessing these impacts.

COMMON UNIT EXPECTED PERFORMANCES (ALIGNED WITH STATE EXPECTED PERFORMANCES):

Standard #	Standard/Expected Performance
C-1	Identify questions that can be answered through scientific investigation.
C-2	Read, interpret and examine the credibility and validity of scientific claims in different sources of information.
C-3	Design and conduct appropriate types of scientific investigations to answer different questions.
C-4	Identify independent variables, dependent variables, constants and controls in an experiment.
C-5	Use appropriate tools and techniques to make observations and gather data.
C-6	Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
C-7	Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.
C-7	Assess the reliability and validity of the data that was generated in an investigation and justify confidence in results.
C-8	Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
C-9	Identify an issue and its implications completely.
C-10	Develop an action plan that addresses all aspects of the issue in detail.
C-11	Use a variety of reliable sources of relevant information, data, knowledge, or experiences to take and support a critical stance.

UNIT I: ECOLOGICAL BALANCE: THE OPPOSING FORCES WITHIN AN ENVIRONMENT WHETHER NATURALLY OCCURRING OR MAN-MADE ARE BEING KEPT BALANCED WITH ONE ANOTHER, WHICH CAN BE DETERMINED THROUGH THE USE FIELD DATA COLLECTION AND ANALYSIS.

Standard #	Standard/Expected Performance
I-1	Identify and explain the role for key components for maintaining a "balanced" ecosystem
I-2	Describe how biodiversity is essential for health ecosystems and is affected by habitat alteration
I-3	Recognize the interrelationship between abiotic and biotic factors in sustaining a stable ecosystem
I-4	Equate changes in an ecosystem can result from human activity including climate change, introduction of non-native species, or expanded development (land use)
I-5	Understand and identify activities impacting the local ecosystem surrounding the school through field assessments

UNIT II: BIODIVERSITY: (INVASIVE PLANT SPECIES) THE VARIETY OF ORGANISMS PRESENT WITHIN A PARTICULAR ECOLOGICAL COMMUNITY, WHICH CAN BE MEASURED BY THE NUMBERS AND TYPES OF DIFFERENT SPECIES.

Standard #	Standard/Expected Performance
II-1	Compose list of woody plant species found in secondary growth woodlands for Southern New England
II-2	Utilize field manuals for identifying woody plants by their unique attributes including leaf pattern and structure, texture of bark and presence of seed bearing bodies
II-3	Construct field quadrants to assess the number of woody plant species located within a specific area
II-4	Identify plants and their characteristics classifying them as an “Invasive Plant Species” in the state of Connecticut
II-5	Explain the environmental threat created through the introduction of invasive plant species
II-6	Conduct field surveys to determine the type and relative abundance of specific woody invasive plant species

UNIT III: AQUATIC HABITATS: (WATER QUALITY ASSESSMENT) THE AQUATIC ENVIRONMENT IS COMPOSED OF PHYSICAL, CHEMICAL AND BIOLOGICAL PARAMETERS WHICH PROVIDE NUMEROUS OPPORTUNITIES FOR DATA COLLECTION AND ANALYSIS. THESE MEASUREMENTS PERMIT THE COMPARISON TO SIMILAR AQUATIC HABITATS WITH COMPARABLE PARAMETERS AND / OR IN GEOGRAPHIC PROXIMITY. THIS ANALYSIS PERMITS US TO DETERMINE THE OVERALL QUALITY OF A SITE.

Standard #	Standard/Expected Performance
III-1	Identify the characteristics / parameters classifying an aquatic environment
III-2	Describe the interconnected relationship between physical and chemical conditions as well as biological diversity (macroinvertebrates)
III-3	Explain the ecological relationships existing between various macroinvertebrate species within the stream habitat
III-4	Conduct field survey to select an appropriate study site
III-5	Collect water samples for chemical analysis in measuring nitrate, phosphate, dissolved oxygen and pH levels
III-6	Collect and categorize field samples of macroinvertebrates found @ stream study site
III-7	Analyze steam flow collections for the presence of fecal coli form bacteria
III-8	Compare field data to base-line data in determining steam quality
III-9	Determine the overall health of stream and potential sources of pollution

Unit IV: HUMAN ACTIVITY: THE VARIOUS DAILY ROUTINES CARRIED OUT BY HUMANS HAVE MEASUREABLE IMPACTS UPON THE SURROUNDING ENVIRONMENT. *PINUS STROBES*, A BIOINDICATOR SPECIES, PROVIDES QUANTIFIABLE METHOD FOR ASSESSING THESE IMPACTS.

Standard #	Standard/Expected Performance
IV-1	List the human activities directly affecting the air quality of New England
IV-2	Explain what pollutants are produced and their impact upon air quality
IV-3	Describe the significance and use of *Pinus strobus* as a bioindicator for air quality assessment
IV-4	Characterize and identify *Pinus strobus* through morphological traits
IV-5	Evaluate and measure appropriate field site used to collect forest stand data
IV-6	Analyze current year pine needles for ozone damage
IV-7	Identify percent occurrence of foliar symptoms characteristic of ozone injury (chlorotic mottle and tipnecrosis)
IV-8	Record the number of years of needles retained in determining the relative health of the test trees
IV-9	Dissect healthy and damaged needle samples for intracellular assessment compared to visual symptoms
IV-10	Extract and analyze chlorophyll content of healthy and damaged needles