DEPARTMENT: SCIENCE	Course Title: Ecology 9 Honors/ Environmental Science 9 Honors Course Numbers: 210 & 211
GRADE(S): 9	PRE-REQUISITES: PRE-REQUISITES (IF ANY): SUCCESSFUL COMPLETION OF ALGEBRA I, A 'B' OR BETTER IN 8TH GRADE MATHEMATICS, OR PERMISSION OF ARHS SCIENCE DEPARTMENT HEAD

UNIT	LENGTH	CONTENT	Skills	Methods of Assessment	Framework Strand(s) & Standard(s) *
Soils, Climates, and Landscapes	4 weeks	Compartments of the biosphere Scientific Methods Soil as a solution Bulk density of soil Soil organic matter (SOM) Essential/critical elements for life Atomic structure Dot diagrams Ionic/covalent bonding Cation exchange Nutrient depletion times Nitrogen Cycle Basic soil taxonomy	Differentiate among mixtures, solutions, compounds, and elements Compare/contrast controlled experiments and correlation Use metric units of mass, volume, and length Determine the bulk density and SOM of soil samples Perform unit conversions Perform mean/mode/median calculations Memorize the names and symbols of essential plant nutrients Draw dot diagrams of essential plant nutrients Identify ionic and covalently bonded molecules Determine the concentrations of NH_4^+, NO_3^-, and PO_4^{3-} Explain cation exchange Measure plant nutrient concentrations and depletion times Explain the nitrogen cycle Differentiate among soil types	Unit Exam Lab: Quantitative model of element depletion times for plant nutrients in the AREF Lab: Constructed soil lab for modeling relationships between organic matter, water holding capacity, and soil air space Quizzes Homework Unit Test	Content: Biology 1.1, 6.4 Chemistry 1.2, 1.3, 2.2, 4.1, 4.2, 4.6, 6.3, 7.1 Earth Science 1.4, 3.1, 3.3, 3.8 Inquiry: SIS1, SIS2, SIS3, SIS4 Math. Skills: All 8 core + sig. figs., and mean/mode/median
Ecosystems	4 weeks	Biotic and abiotic factors Types of energy Energy units and conversions Autotrophs and heterotrophs Photosynthesis and cellular	Differentiate between biotic and abiotic factors Discuss forms of energy and their transformations Perform calculations with	Unit Exam Lab: Quantitative model of energy flow thru ARHS Exp. Forest Includes: Annual light	Content: Biology 1.1, 1.2, 2.4, 3.3, 6.3, 6.4

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		respiration Carbohydrates Carbon cycle GPP, NPP, and NEE Pyramids of numbers and biomass Mass/energy flow through food webs Ecosystem modeling	energy units Perform unit conversions Identify characteristics of autotrophs and heterotrophs Interpret and balance the equations for photosynthesis and cellular respiration Determine total light energy, area, and leaf litter associated with a forest plot Create histograms Perform standard deviation calculations Explain the carbon cycle for a terrestrial ecosystem with an atmospheric, plant, animal, and soil pool Apply the concepts of GPP, NPP, and NEE to a carbon cycle Construct pyramids of numbers and biomass that are supported by calculations Model a forest ecosystem	input to system, annual NPP determination, population densities, and Light use efficiency Mini-investigations Biomass pyramids Quizzes Homework Unit Test	Chemistry 4.1, 4.6, 5.1 Physics 3.1, 6.2 Earth Science 1.2, 3.2 Inquiry: SIS1, SIS2, SIS3,SIS4 Math. Skills: All 8 core + W/sq. m, frequency, wavelength, joules, Cal, cal, sig. figs. histograms, stan. dev.
Communities & Populations	4 weeks	Ecological Niche Inter and infra-specific competition Symbiosis Keystone species Evolution by natural selection Biodiversity Population dynamics Exponential growth Carrying capacity Population and population density Density dependent/independent factors	Differentiate among ecosystems, communities, and populations Define niche and explain factors that determine niche Differentiate between inter and infra-specific competition Define symbiosis and quantify a symbiotic relationship Evaluate the importance of a keystone species Describe the process of natural	Unit Exam Lab: Quantitative model of carrying capacity influenced by nutrient levels in algae cultures Lab: Effect of invasive Species on the regeneration of bio-diversity in secondary successional forests in New England Quizzes Homework	Content: Biology 1.1, 1.2, 3.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4 Chemistry 4.6 Inquiry: SIS1, SIS2 SIS3, SIS4

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			selection and its influence on community relationships Discuss the effect of evolution on biodiversity Perform population growth calculations Use a compound microscope properly Use a colorimeter to determine cell counts Maintain an algae culture Monitor logistic growth and determine a carrying capacity Differentiate between population and population density and explain how population density can amplify population limiting factors Use age structure diagrams To quantify interspecific competition	Unit Test	Math. Skills: All 8 core + microliters, exponential growth, sig. figs., stan. dev., and concentra-tion units
Agriculture, Water, and Soils	4 Weeks	History of human population growth Major dietary molecules Industrial and subsistence agriculture Water use patterns Basic forms of water pollution Biochemical oxygen demand Pesticides Dose response curves Bioaccumulation	Calculate the trophic efficiencies of different diets Describe water use patterns in the United States and world Characterize the 5 most common forms of water pollution Measure nitrogen concentrations in the AREF	Unit Exam Lab: Nitrogen cycling in soils modified by agriculture Lab: Constructing LD_{50} curves for soils impacted by irrigation Quizzes	Content: Biology 1.1, 1.2, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4 Inquiry: SIS1, SIS2,

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		Biomagnification American dust bowl African Sahel Importance of biodiversity Extinction/Mass extinction Endangered/Threatened species Factors causing biodiversity decline Global fish stocks Tragedy of the commons	soils Differentiate between BOD and DO Compare and contrast events of the "Dust Bowl" and the African Sahel Form an opinion about the costs and benefits of pest-icides Determine the dose-response curves of common toxins Discuss the importance of world biodiversity Discuss the tragedy of the commons	Homework	SIS3, SIS4 Math. Skills: All 8 core + stan. dev., instantaneous growth, exponential growth, regression
Energy	4 Weeks	Costs and benefits of fossil fuels Structure of traditional power plant Energy units and conversions Efficiency/Demand calculations Atomic structure and isotopes Chemical vs. Nuclear energy Radioactivity Nuclear equations Structure of PWR reactor Three Mile Island and Chernobyl Yucca Mountain Repository Direct solar energy technologies Biomass energy Wind Power Hydro Power Conservation and efficiency	Discuss the costs and benefits of using fossil fuels Diagram a power plant Explain the relationship between magnetism and electricity Use kWh, BTU, and joules correctly Perform calculations of power plant efficiency and building energy demand Measure the energy demand of Amherst schools Measure the population density of Amherst schools Interpret linear regressions Use nuclear nomenclature Describe the decay process Distinguish between chemical and nuclear energy/equation Explain the structure and	Unit Exam Lab: Energy efficiency of three Amherst schools as determined by regressions of their population densities vs their energy demands and the implications for the region's population, economy, and the atmosphere in general Mini-investigations Energy content of biomass fuels using simple calorimeters Solar collector construction and efficiency Quizzes Homework	Content: Chemistry 2.2, 2.5, 2.6, 2.7, 6.3 Physics 3.1, 3.3, 5.6, Earth Science 1.1, 2.1, 2.2, 3.1, 3.5, Inquiry: SIS1, SIS2, SIS3,SIS4 Math. Skills: All 8 core + sig. figs., kWh, BTU, J, DD, mrem,

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			function of a PWR Assess the damage caused by Three Mile Island and Chernobyl Evaluate the costs and benefits of the Yucca Mountain nuclear waste repository Differentiate between direct and indirect solar technology Build and measure the efficiency of a solar collector Evaluate the limits of biomass energy Discuss the potential of wind and hydro power Evaluate conservation and efficiency technologies		S.A., W/sq. m, cal, Cal, stan. dev., regression
Air Pollution & Global Atmospheric Change	4 Weeks	Atmospheric gases Classes of air pollution Clean Air Act pH scale Chemical equations/Acid Rain Acid Rain vulnerable regions Effects of Acid Rain Dot formulas and models Greenhouse gases Carbon dioxide trends Greenhouse Effect Effects of Global Warming Global Warming vs Ozone Depletion Mitigation of Global Warming	List the common gases in the atmosphere by concentration Characterize air pollutants by formula, effects, and conc. Discuss the success of the Clean Air Act Use the pH scale correctly Balance chemical equations that represent the formation of acid rain Measure acid levels in exhaust Evaluate the threat posed to particular regions by acid rain Use dot formulas and models to represent the major greenhouse gases Interpret data sets showing changes in carbon dioxide levels in Earth's atmosphere	Unit Exam Lab: Determining the ratio of carbon dioxide emissions from cars in the ARHS parking lot to carbon dioxide absorption by trees and soil in the ARHS Experimental Forest and the implication of the findings for land use and personal transportation habits. Mini-investigations Using models to understand why some molecules absorb infra-red light Measuring nitrogen	Content: Biology 1.1, 6.4 Chemistry 4.1, 4.6, 5.1, 8.2 Physics 3.1, 3.3, 3.4, 4.1, 6.2 Earth Science 1.2, 1.3, 2.2, Inquiry: SIS1, SIS2, SIS3, SIS4

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			Diagram the Greenhouse Effect Use wavelength and frequency to characterize types of light Determine the kg of carbon stored in soil samples Determine kg of carbon stored in a forest plot Determine the kg of carbon emitted by various cars Discuss the world implications of global warming Differentiate between global warming and the ozone hole Evaluate actions to mitigate Global Warming	oxides in car exhaust with a field-based back titration method Quizzes Homework	Math. Skills: All 8 core + sig. figs., stan. dev., regression, mg/L, ppm, % volume