Ecology Course Syllabus

ECO.LS2: Ecosystems: Interactions, Energy, and Dynamics

1) Construct explanations for patterns relating to climate, flora, and fauna found in major terrestrial biomes (deserts, temperate grasslands, temperate forests, tropical grasslands, tropical forests, taiga, and tundra).

2) Research examples of adaptations of organisms in major marine and freshwater ecosystems. Develop an explanation for the formation of these adaptations and predict how the organisms would be affected by environmental disturbances or long-term ecological changes.

3) Create a model of an ecosystem depicting the interrelationships among organisms with a variety of niches. Use the model to explain resource needs of these organisms.

4) Compare patterns of stratification and zonation in various terrestrial and aquatic ecosystems. Construct an argument regarding the importance of these patterns in ecosystem diversity.

5) Using the laws of conservation of energy, create a model of energy flow through the biosphere. Use the model to explain limitations in energy transfer and the need for ongoing energy input.

6) Compare pyramids of energy, numbers, and biomass to calculate rates of productivity within food chains and food webs among various biomes. Using mathematics, explain the relationship between biomass and trophic levels.

7) Use models to explain relationships among biogeochemical cycles (water, carbon, nitrogen, phosphorus).

8) Create a diagram tracing carbon through the processes of photosynthesis and respiration. Use the diagram to construct an explanation for the importance of photosynthesis and respiration in the carbon cycle.

9) Construct an argument from evidence regarding the importance of the microbial community in nutrient cycling.

10) Plan and carry out an investigation measuring species diversity (richness and evenness) and density in a local ecosystem.

11) Obtain information regarding distribution patterns (clumped, uniform, random) and make predictions regarding types of organisms that will exhibit each type.

12) Use mathematical models to construct an explanation for population growth patterns and rates observed in ecosystems. Account for both density-dependent and density-independent factors in your explanation.

13) Analyze data regarding exponential and logistic population growth patterns. Use the data to create mathematical models to make predictions regarding carrying capacity.

14) Obtain information regarding survivorship curves and reproductive strategies of various species. Choose one of these strategies and construct an argument regarding its effectiveness.

15) Compare types of competition and construct an explanation for the importance of niche differentiation in response to competition.

16) Use a mathematical model to examine predator-prey interactions. Based on the model, construct an argument regarding the importance of predators in maintaining stability of prey populations.

17) Based on information obtained from research, construct explanations regarding mechanisms by which prey protect themselves from predation (including herbivory).

18) Use models to explain the impacts of types of symbiosis on the species involved in the relationship.
19) Carry out an investigation of stability and change within a local ecosystem. Identify signs of succession (primary or secondary). Based on investigation findings, make predictions regarding future changes in this ecosystem.

20) Plan and carry out an investigation examining kinesis and taxis in a simple organism. Construct and share explanations regarding observations.

21) Gather information regarding types of learned behaviors (fixed action patterns, imprinting, imitation, habituation, trial-and-error, associative learning – classical conditioning, operant conditioning). Ask questions regarding the importance of these behaviors in species survival.

22) Construct an explanation for the relationship between sexual selection and sexual dimorphism.

23) Obtain and evaluate information regarding the relationship between altruistic behavior and kin selection.

ECO.LS4: Biological Change: Unity and Diversity

1) Develop and revise a system for classifying organisms. Justify choice of information (morphology, molecular data, energy acquisition, habitat, niche, trophic level, reproduction, etc.) used in developing your system.

2) Construct an argument, citing evidence, supporting the influence of natural selection on changes in populations over time.

3) Design and carry out an investigation examining the importance of animal behaviors and plant tropisms for survival.

4) Engage in argument from evidence regarding the importance of coevolution in species interactions (competition, predation, symbiosis).

5) Construct an explanation for the importance of keystone species in ecosystem stability.

6) Compare resource needs of specialists versus generalists. Construct an explanation regarding the vulnerability of specialists when faced with ecosystem disturbances.

7) Research and evaluate the effectiveness of strategies for maintenance of biodiversity.

ECO.ESS3: Earth and Human Activity

1) Research and evaluate the effectiveness of public lands (state parks, national parks, wildlife refuges, wilderness areas) in sustaining biodiversity.

2) Construct an argument in support of protection of native species. Develop responses to anticipated counterarguments.

3) Engage in argument from evidence regarding the impacts of human activity on climate change. Design solutions to address these impacts.

ECO.ETS2: Links Among Engineering, Technology, Science, and Society

1) Engage in argument from evidence regarding the impact engineering and technology have on biodiversity.

2) Research and communicate information on a career in ecology. Analyze the role of engineering, technology, and science in that career.