Objective Sheet: Ecology

**Tested Objectives**

*ECOLOGY*

**Bio.2.1.1**

• Deconstruct the carbon cycle as it relates to photosynthesis, cellular respiration, decomposition and climate change.

• Summarize the nitrogen cycle (including the role of nitrogen fixing bacteria) and its importance to synthesis of proteins and DNA.

• Identify factors that influence climate such as:

* greenhouse effect (relate to carbon cycle and human impact on atmospheric CO2)
* natural environmental processes (relate to volcanic eruption and other geological processes)

• Explain the recycling of matter within ecosystems and the tendency toward a more disorganized state.

• Analyze energy pyramids for direction and efficiency of energy transfer.

-Living systems require a continuous input of energy to maintain organization. The input of radiant energy which is converted to chemical energy allows organisms to carry out life processes.

-Within ecosystems energy flows from the radiant energy of the sun through producers and consumers as chemical energy that is ultimately transformed into heat energy. Continual refueling of radiant energy is required by ecosystems.

**Bio 2.1.3**

• Identify and describe symbiotic relationships such as mutualism and parasitism. (middle school review)

• Explain patterns in predator /prey and competition relationships and how these patterns help maintain stability within an ecosystem with a focus on population dynamics.

Note: *There is much debate about whether commensalistic relationships are just early mutualism. We may just not understand the benefits to each organism.*

**Bio.2.1.4**

• Generalizing that although some populations have the capacity for exponential growth, there are limited resources that create specific carrying capacities and population sizes are in a dynamic equilibrium with these factors. (e.g. food availability, climate, water, territory).

• Explain how disease can disrupt ecosystem balance. (Examples: AIDS, influenza, tuberculosis, Dutch Elm Disease, Pfiesteria, etc.)

*HUMAN IMPACT*

**Bio.2.1.1**

• Deconstruct the carbon cycle as it relates to photosynthesis, cellular respiration, decomposition and climate change.

• Identify factors that influence climate such as:

-greenhouse effect (relate to carbon cycle and human impact on atmospheric CO2)

-natural environmental processes (relate to volcanic eruption and other geological processes)

**Bio.2.1.4**

• Generalizing that although some populations have the capacity for exponential growth, there are limited resources that create specific carrying capacities and population sizes are in a dynamic equilibrium with these factors. (e.g. food availability, climate, water, territory).

• Interpret various types of population graphs – human population growth graphs indicating historical and potential changes, factors influencing birth rates and death rates, and effects of population size, density and resource use on the environment.

• Explain how disease can disrupt ecosystem balance. (Examples: AIDS, influenza, tuberculosis, Dutch Elm Disease, Pfiesteria, etc.)

**Bio.2.2.1**

• Summarize how humans modify ecosystems through population growth, technology, consumption of resources and production of waste.

• Interpret data regarding the historical and predicted impact on ecosystems and global climate.

• Explain factors that impact North Carolina ecosystems. (Examples: acid rain effects in mountains, beach erosion, urban development in the Piedmont leading to habitat destruction and water runoff, waste lagoons on hog farms, Kudzu as an invasive plant, etc.).

**Bio.2.2.2**

• Explain the impact of humans on natural resources (e.g. resource depletion, deforestation, pesticide use and bioaccumulation )

• Exemplify conservation methods and stewardship.

**Essential Vocabulary** (Pre-made glossary provided online)

*Ecology:*

Biosphere, biomes ecosystem, biotic, abiotic, communities, populations, niche, trophic level, producer, autotroph, consumer, heterotroph, herbivore/primary consumer, carnivore/secondary or tertiary consumer, omnivore, scavenger, decomposer, recycling, food web, radiant/solar energy, chemical energy, energy pyramid, ecological efficiency, 10% rule, entropy/disorder, water/hydrologic cycle, precipitation, infiltration, run-off, evaporation, transpiration, carbon cycle, photosynthesis, cellular respiration, greenhouse effect, fossil fuel, climate change, nitrogen cycle, nitrogen fixation, competition, predation, predator, prey, symbiosis, mutualism, parasitism, commensalism, biotic potential, J-curve, exponential growth, limiting factors, S-curve, carrying capacity, dynamic equilibrium, density-dependent factors, density-independent factors

*Human Impact:*

Agricultural revolution, industrial revolution, urbanization, technology, natural resources, conservation, stewardship, reduce, reuse, recycle, sustainability, global warming / climate change, greenhouse gases, thermal expansion, beach erosion, air pollution, acid precipitation, NOx and SOx, water pollution, waste lagoons, Pfisteria, biodiversity, habitat destruction, deforestation, fragmentation, impervious surface, invasive species, kudzu, dutch elm disease, bioaccumulation, biomagnifications, endangered species, extinction

**Statements to Master**

*ECOLOGY*

1. Explain energy is transferred within an ecosystem from an organized to a disorganized state. Be sure to use the following terms in your explanation:
   1. Solar/radiant energy
   2. Chemical energy
   3. Heat energy
2. Diagram and explain the water cycle
3. Diagram and explain the carbon cycle
4. Summarize the nitrogen cycle, explaining the need for bacteria to “fix” atmospheric nitrogen so that is accessible to living organisms so that they may manufacture proteins and DNA
5. Identify and describe the trophic levels in an ecosystem by constructing /interpreting food webs
6. Calculate the amount of energy transferred between different trophic levels on an energy pyramid using the 10% rule
7. Explain that living organisms in a community interact with one another in a variety of ways including competition, predation, and symbiotic relationships
8. Identify and explain examples of symbiosis including mutualism, commensalism and parasitism
9. Graph a population experiencing unlimited exponential growth (J-curve)
10. Graph a population experiencing stabilization following a period of exponential growth (S-curve)
11. Explain how the carrying capacity for a population is determined by environmental limits
12. Identify density-dependent and density-independent limiting factors for a specific population
13. Explain how predators and their prey exist in a state of dynamic equilibrium using a graph as evidence of your explanation.
14. Explain dynamic equilibrium within a population. Be sure to include carrying capacity and limiting factors within your explanation.
15. Explain how the predator/prey dynamics and competition among organisms helps maintain ecosystem stability.

*HUMAN IMPACT*

1. Evaluate human impact on the carbon cycle pertaining to the use of fossil fuels
2. Differentiate between Earth’s normal greenhouse effect and how human impact has altered the greenhouse effect.
3. Identify and describe factors that have contributed to the growth of the human population including agricultural/industrial revolution and discuss the impact of disease epidemics. Use a graph of the human population from before the industrial revolution to present day as evidence for your explanation.
4. Interpret age-structure diagrams of developing (fast-growing) and developed (slow-growing, stable, or declining) countries and explain the relationship to human birth and death rates
5. Differentiate between renewable versus non-renewable resources. Provide a real-life explain for each resource
6. Discuss the impact humans have had on non-renewable resources.
7. Explain the causes of climate change resulting from human activities (inputs of CO2 and CH4)
8. Discuss impacts of climate change on a global and a local scale
9. Explain how air pollutants from human input can result in acid precipitation
10. Discuss the general impacts of acid precipitation and apply these impacts to our local ecosystems
11. Identify sources of water pollutants contributed by humans
12. Discuss the general impacts of water pollution and apply these impacts to our local ecosystems
13. Discuss the impact of habitat destruction (deforestation, fragmentation, pollution) on the biodiversity of an ecosystem
14. Discuss the introduction of non-native, invasive species by humans and describe the impact on other species
15. Analyze the impact of pesticide use on other organisms through bioaccumulation and biomagnification, and explain why organisms at higher trophic levels are most at risk
16. Explain the term conservation and identify simple ways to conserve natural resources in my everyday life
17. Provide examples of sustainable environmental practices that exemplify good environmental stewardship