Population and Community Ecology

Essential knowledge 2.D.1: All biological systems from cells and organisms to populations, communities and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy.

b) Organism activities are affected by interactions with biotic and abiotic factors.

*Examples include:*
- Symbiosis (mutualism, commensalism, parasitism)
- Predator–prey relationships
- Water and nutrient availability, temperature, salinity, pH

c) The stability of populations, communities and ecosystems is affected by interactions with biotic and abiotic factors.

*Examples include:*
- Water and nutrient availability
- Availability of nesting materials and sites
- Food chains and food webs
- Species diversity
- Population density
- Algal blooms


a) Interactions between populations affect the distributions and abundance of populations.

*Evidence of learning includes an understanding of each of the following:*
1. Competition, parasitism, predation, mutualism and commensalism can affect population dynamics.
2. Relationships among interacting populations can be characterized by positive and negative effects, and can be modeled mathematically (predator/prey, epidemiological models, invasive species).
3. Many complex symbiotic relationships exist in an ecosystem, and feedback control systems play a role in the functioning of these ecosystems.

*Specific symbiotic interactions are beyond the scope of the course and the AP Exam.

b) A population of organisms has properties that are different from those of the individuals that make up the population. The cooperation and competition between individuals contributes to these different properties.

c) Species-specific and environmental catastrophes, geological events, the sudden influx/depletion of abiotic resources or increased human activities affect species distribution and abundance.
Essential knowledge 4.A.5: Communities are composed of populations of organisms that interact in complex ways.

a) The structure of a community is measured and described in terms of species composition and species diversity.

b) Mathematical or computer models are used to illustrate and investigate population interactions within and environmental impacts on a community.

   *Examples include:*
   
   - Predator/prey relationships spreadsheet model
   - Symbiotic relationship
   - Graphical representation of field data
   - Introduction of species
   - Global climate change models

c) Mathematical models and graphical representations are used to illustrate population growth patterns and interactions.

   *Evidence of learning includes an understanding of each of the following:*
   
   1. Reproduction without constraints results in the exponential growth of a population.
   2. A population can produce a density of individuals that exceeds the system’s resource availability.
   3. As limits to growth due to density-dependent and density-independent factors are imposed, a logistic growth model generally ensues.
   4. Demographics data with respect to age distributions and fecundity can be used to study human populations.

Essential knowledge 4.C.4: The diversity of species within an ecosystem may influence the stability of the ecosystem.

a) Natural and artificial ecosystems with fewer component parts and with little diversity among the parts are often less resilient to changes in the environment.

b) Keystone species, producers, and essential abiotic and biotic factors contribute to maintaining the diversity of an ecosystem. The effects of keystone species on the ecosystem are disproportionate relative to their abundance in the ecosystem, and when they are removed from the ecosystem, the ecosystem often collapses.