Components of Big Idea 4 within Chapter 54

**Enduring understanding 4.A: Interactions within biological systems lead to complex properties.**

Essential knowledge 4.A.5: Communities are composed of populations of organisms that interact in complex ways.

1. The structure of a community is measured and described in terms of species composition and species diversity.
2. Mathematical or computer models are used to illustrate and investigate population interactions within and environmental impacts on a community. [See also **3.E.1, 3.E.3**]  
   *To foster student understanding of this concept, instructors can choose an illustrative example such as:*

• Predator/prey relationships spreadsheet model

• Symbiotic relationship

• Graphical representation of field data

• Introduction of species

• Global climate change models

Essential knowledge 4.A.6: Interactions among living systems and with their environment result in the movement of matter and energy.

1. Energy flows, but matter is recycled. [See also **2.A.1**]
2. Changes in regional and global climates and in atmospheric composition influence patterns of primary productivity.
3. Organisms within food webs and food chains interact. [See also **2.D.1**]
4. Food webs and food chains are dependent on primary productivity.
5. Models allow the prediction of the impact of change in biotic and abiotic factors.  
   *Evidence of student learning is a demonstrated understanding of each of the following:*

1. Competition for resources and other factors limits growth and can be described by the logistic model.

2. Competition for resources, territoriality, health, predation, accumulation of wastes and other factors contribute to density-dependent population regulation.

1. Human activities impact ecosystems on local, regional and global scales. [See also **2.D.3**]  
   *Evidence of student learning is a demonstrated understanding of each of the following:*

1. As human populations have increased in numbers, their impact on habitats for other species have been magnified.

2. In turn, this has often reduced the population size of the affected species and resulted in habitat destruction and, in some cases, the extinction of species.

1. Many adaptations of organisms are related to obtaining and using energy and matter in a particular environment. [See also **2.A.1**, **2.A.2**]

**Enduring understanding 4.B: Competition and cooperation are important aspects of biological systems.**

Essential knowledge 4.B.3: Interactions between and within populations influence patterns of species distribution and abundance.

1. Interactions between populations affect the distributions and abundance of populations.  
   *Evidence of student learning is a demonstrated 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.*

1. 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.
2. Species-specific and environmental catastrophes, geological events, the sudden influx/depletion of abiotic resources or increased human activities affect species distribution and abundance. [See also **1.A.1**, **1.A.2**]  
   *To foster student understanding of this concept, instructors can choose an illustrative example such as:*

• Loss of keystone species

• Kudzu

• Dutch elm disease

Essential knowledge 4.B.4: Distribution of local and global ecosystems changes over time.

1. Human impact accelerates change at local and global levels. [See also **1.A.2**]  
   *To foster student understanding of this concept, instructors can choose an illustrative example such as:*

• Logging, slash and burn agriculture, urbanization, monocropping, infrastructure development (dams, transmission lines, roads), and global climate change threaten ecosystems and life on Earth.

• An introduced species can exploit a new niche free of predators or competitors, thus exploiting new resources.

• Introduction of new diseases can devastate native species.

*Illustrative examples include*:

• Dutch elm disease

• Potato blight

• Small pox [historic example for Native Americans]

**Enduring understanding 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.**

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

1. Natural and artificial ecosystems with fewer component parts and with little diversity among the parts are often less resilient to changes in the environment. [See also **1.C.1**]
2. 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.

Name: Period: Date:

**Relating the AP Biology Curriculum Framework to Chapter 54: Community Ecology**

In this assignment, you will be relating the material you read in chapter 54 to the actual curriculum framework for AP Biology, specifically the “essential knowledge” contained in Big Idea 4. Use the reference sheet provided in order to familiarize yourself with the curriculum framework, then for each of the five “essential knowledge” statements, describe ONE example from the reading that demonstrates the concept in the statement.

1. **Essential Knowledge 4.A.5:** Communities are composed of populations of organisms that interact in complex ways.

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1. **Essential Knowledge 4.A.6:** Interactions among living systems and with their environment result in the movement of matter and energy.

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1. **Essential Knowledge 4.B.3:** Interactions between and within populations influence patterns of species distribution and abundance.

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1. **Essential Knowledge 4.B.4:** Distribution of local and global ecosystems changes over time.

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

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