**Chapter 6**

**From ther AP Outline: The Living World (10–15%)**
**A. Ecosystem Structure**
          Biological populations and communities; ecological niches; interactions among species; keystone species; species

 diversity; major terrestrial and aquatic biomes

**C. Ecosystem Diversity**
          Biodiversity; natural selection; evolution; ecosystem services

**D. Natural Ecosystem Change**
          Climate shifts; species movement; ecological succession

**Population Biology Concepts (10–15%)**

1. *Population ecology; carrying capacity; reproductive strategies; survivorship curves*

 **B.  Human Population**

 1.  Human Population Dynamics - *Historical population sizes; distribution; fertility rates; growth rates and doubling*

 *times; demographic transition; age-structure diagrams*

 2.  Population Size - *Strategies for sustainability; case studies; national policies*

 3.  Impacts of Population Growth *Hunger; disease; economic effects; resource use; habitat destruction*

**Reading Questions**

 **Opening Case Study : New England Forests Come Full Circle: pgs. 149-150**

1. Fill in 5 key events in the re-establishment of the New England forest in the Opening Story:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. Farmers begin leaving | 2. | 3. | 4. | 5. | 6. | 7. Broadleaf forest re-established |

 **Nature exists at several levels of complexity**: pgs 150-151

1. Distinguish between each level of analysis:

|  |  |  |
| --- | --- | --- |
|  | What does this level consist of? | What do scientists study at this level? |
| Individual |  |  |
| Population | All the individuals of a single species living in a given area at one time |  |
| Community |  |  |
| Ecosystem |  | Flows of energy and matter or a large scale (ex: the cycling of C/N/P/H2O in a lake) |
| Biosphere |  |  |

1. Which level of analysis (from above) would be most appropriate for a scientist to use in each scenario?
	* 1. Monitoring the Grey Wolves of Yosemite
		2. Investigating the connections among organisms in a soil sample
		3. Determining whether or not natural selection favors light or dark coloration in mice
		4. Evaluating the status of the Florida Everglades
2. How does the Opening Story demonstrate the importance of community-level analysis and interactions between species?

**Population ecologists study the factors that regulate population abundance and distribution**: pgs 151-154

1. When considering a population as a system, what 2 processes are inputs that increase population size and what 2 processes are outputs that decrease population size?

Input 1: Output 1:

Input 2: Output 2:

1. Five major characteristics help us understand how populations change over time:

|  |  |  |
| --- | --- | --- |
|  | Why is this factor important? | How could this factor apply to the New England forest in the Opening Story? |
| Population Size |  |  |
| Population Density |  |  |
| Population Distribution |  |  |
| Population Sex Ratio |  | Ecologists may study the percentage of female *Microrhopala vittata* beetles |
| Population Age Structure | Determines future growth potential (via individuals of reproductive age) |  |

1. Density-dependent factors & density-independent factors can affect population sizes and growth rates:
	* + - 1. True/false: Wildfires occurring in the Southern California chaparral (shrubland biome) influence populations of local species in a density-dependent way.
				2. What variable served as the limiting resource in Gause’s *paramecium* experiment? \_\_\_\_\_\_\_\_\_
				3. Explain how the carrying capacity (k) of an environment is determined:
				4. What are common limiting resources for terrestrial plants? 1. 2. 3.
				5. What are common limiting resources for animal populations? 1. 2. 3.
				6. True or false: Density-independent factors deal with limiting resources
2. Predict what would happen to the population sizes of *P. aurelia* and *P. caudatum* if Gause had continued his experiment by alternating between high-food and low-food conditions each day:

**Growth Models help ecologists to understand population changes:** pgs. 154-161

1. The Exponential Growth Model
	1. What does the intrinsic growth rate (r) for a species measure?
	2. Chart the growth of the following population of mice at a growth rate of 10% per year:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year: | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Mice: | 100 |  |  |  |  |  |  |  |  |  |  |

1. The Logistic Growth Model
	1. Why is the exponential growth model usually insufficient to describe real populations?
	2. Why does population growth slow as it approaches the carrying capacity of its environment?
	3. What factors prevent the continued growth of populations beyond the carrying capacity?
2. Variations on Logistic Growth
	1. Why is population overshoot always followed by a die-off?
	2. True/false: during population overshoot, the environment’s carrying capacity increases.
3. Reproductive Strategies and Survivorship Curves
	1. Characteristics of k-selected and r-selected species:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Characteristics** | **Reproduction Speed** | **Likely to overshoot?** | **Example** | **Survivorship Curve Type** |
| **k-selected species** |  |  |  |  | Type I |
| **r-selected species** | Small, short lives, many offspring |  |  |  |  |

* 1. Which type of species can evolve faster? Explain why.
	2. True/false: Most organisms show strict k-selected or r-selected reproduction strategies
	3. Which type of species is at greater risk for extinction? Explain why.

**Community ecologists study species interactions:** pgs. 161-168

1. Competition
	1. Why did Gause’s experiment growing 2 strains of paramecium in the same environment produce a different outcome from when they he grew them separately?
	2. Why can’t two species simultaneously share the same realized niche?
	3. Why is resource partitioning advantageous for species that would otherwise be competing?
	4. Identify each of the following as an example of the competitive exclusion principle, temporal resource partitioning, spatial resource partitioning or morphological resource partitioning:
		1. Several species of Warbler Birds hunt insects in the same types of trees, but each feeds in a different part of the tree
		2. When wolves were absent from Yosemite, deer grazed many plant species so heavily that other herbivore species were unable to establish themselves
		3. Many different species of bats use a single watering hole, but each at different times
		4. Different species of butterfly have tongues of varying lengths, each specialized to the shape of the flowers produced by the plants it feeds on
		5. Invasive species that out-compete native species for key resources often drive the native species to extinction
2. Predation
	1. List 2 distinguishing characteristics of each type of predation:

|  |  |  |
| --- | --- | --- |
|  | **Characteristic 1** | **Characteristic 2** |
| **True predators** |  |  |
| **Herbivores** |  |  |
| **Parasites** |  |  |
| **Parasitoids** |  |  |

1. Mutualism
	1. Under what conditions would natural selection favor mutualism between two species?
	2. True/false: In a mutualistic relationship, neither species evolves traits suited to helping the other
	3. Which of the following are mutualistic: (Lichens) (Viruses) (Coral) (Acacia trees) (African lions)
2. Commensalism
	1. True/false: In commensalism, both species benefit
3. Keystone Species
	1. How could an ecologist identify a keystone species in any given ecosystem?
	2. Why are sea stars and beavers considered to be keystone species in their habitats?

**The Composition of a community changes over time: pgs. 168-170**

1. Primary Succession
	1. Which types of organisms transform bare rock in to young soil?
	2. Where do the mineral and organic components of the new soil come from?
	3. What role do mid-successional species such as grasses and wildflowers play in transforming soil?
	4. Why do mid-successional species eventually get displaced by late-succession species?
	5. True/false: the number of species present always increases as succession proceeds.
2. Secondary Succession
	1. How does secondary succession differ from primary succession?
	2. How is the progression of species in secondary succession similar to that of primary succession?
	3. Why has the use of the term *climax stage* fallen out of favor among scientists?
	4. True/false: The Opening Story describes a sequence of primary succession
	5. True/false: In the Opening Story, Goldenrods are late-successional spcies
3. Aquatic Succession
	1. On which surfaces does succession occur in the rocky intertidal zone of the Pacific Coast?
	2. Describe how are lakes can become filled in during aquatic succession:

**The species richness of a community is influenced by many factors:** pgs. 171-172

1. Species Richness, Latitude, Time, Theory of Island Biogeography

|  |  |  |
| --- | --- | --- |
|  | **Influence of this factor on species richness?** | **What do you think causes this?** |
| Latitude |  |  |
| Time | The *older* a habitat, the *greater* its species richness is likely to be; *younger* habitats have *lower* species richness |  |
| Habitat Size |  | *Larger* habitats present *more* niches; *smaller* habitats offer *fewer* resources |
| Distance from other habitats |  |  |

**Chapter 6 Vocabulary List**

|  |  |  |
| --- | --- | --- |
| 1 | Population -  | . |
| 2 | Community -  | . |
| 3 | Population ecology -  | . |
| 4 | Population size - | . |
| 5 | Population density - | . |
| 6 | Population distribution - | . |
| 7 | Sex ratio - | . |
| 8 | Age structure - | . |
| 9 | Density-dependent factors - | . |
| 10 | Limiting resource - | . |
| 11 | Carrying capacity (k) - | . |
| 12 | Density-independent factors - | . |
| 13 | Growth rate - | . |
| 14 | Intrinsic growth rate (r) - | . |
| 15 | Exponential growth model - | . |
| 16 | Logistic growth model - | . |
| 17 | Overshoot - | . |
| 18 | Die-off - | . |
| 19 | k-selected species - | . |
| 20 | r-selected species - | . |
| 21 | Survivorship curves - | . |
| 22 | Corridors - | . |
| 23 | Metapopulations - | . |
| 24 | Community ecology - | . |
| 25 | Competition - | . |
| 26 | Competitive exclusion principle - | . |
| 27 | Resource partitioning - | . |
| 28 | Predation - | . |
| 29 | True predators - | . |
| 30 | Herbivores - | . |
| 31 | Parasites - | . |
| 32 | Parasitoids - | . |
| 33 | Mutualism - | . |
| 34 | Commensalism - | . |
| 35 | Symbiotic relationship - | . |
| 36 | Keystone species - | . |
| 37 | Predator-mediated competition - | . |
| 38 | Ecosystem engineers - | . |
| 39 | Ecological succession - | . |
| 40 | Primary succession - | . |
| 41 | Secondary succession - | . |
| 42 | Pioneer species - | . |
| 43 | Theory of island biogeography - | . |