**Unit 2 - Energy and Ecosystems**

**MCAS Standards:** This unit addresses the following MA State Frameworks in Biology:

**6.1** Explain how birth, death, immigration, and emigration influence population size.

**6.2** Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.

**6.3** Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, mutualism) add to the complexity of biological communities.

**6.4** Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an

ecosystem, and how oxygen cycles through photosynthesis and respiration.

**SIS 1.** Make observations, raise questions, and formulate hypotheses.

**SIS 2**. Design and conduct scientific investigations.

**SIS 3**. Analyze and interpret results of scientific investigations.

**SIS 4.** Communicate and apply the results of scientific investigations.

**Big Ideas:**

1. Ecosystems provide a means for energy to be passed among organisms, and nutrients to be recycled.
2. Population levels and biodiversityare controlled by the resources and community members of an ecosystem.

**Essential Questions:**

1. How is life dependent on the interactions of organisms and resources in an ecosystem

**Reading:** Text Chapter 3-5, and Sections 6-2 and 6-3.

**Objectives:** Upon completion of this unit, you should be able to:

*Topic 1: Organisms and energy (Chapter 3)*

1. Define Ecology.
2. Define and relate the terms: species, population, community, ecosystem, biome, and biosphere.
3. Define and relate the terms: autotroph, producer, photosynthesis, and chemosynthesis.
4. Define and relate the terms: heterotroph and consumer.
5. Define and provide an example of: herbivore, carnivore, omnivore, detritivore, and decomposer.
6. Explain how energy flows through an ecosystem by illustrating with a food chain.
7. Explain the flow of energy through a food web.
8. Define trophic level and apply it to organisms in a food web.
9. Explain how ecological pyramids can be used to show the energy, biomass, and population number at each trophic level of an ecosystem.
10. Define biological magnification and explain how pollution affects the trophic levels of an ecosystem. (p152)

*Topic 2: Nutrient and resource cycling (Chapter 3)*

1. Diagram and explain the water cycle, carbon cycle, phosphorus cycle, and nitrogen cycle.
2. Define primary productivity and limiting nutrient. Explain how nutrient pollution of lakes causes algal blooms.

*Topic 3: Community ecology (Chapter 4)*

1. Define and list examples of biotic and abiotic factors and explain how they influence ecosystems.
2. Define and give examples of niche and habitat.
3. Explain how organisms interact in a community through competition, predation, and symbiosis (mutualism, commensalism, and parasitism).
4. Explain how the introduction of exotic/invasive species (p153) into an unoccupied habitat can affect that area.
5. Describe the stages of primary succession in an ecosystem.
6. Describe, using examples, secondary succession in an ecosystem.

*Topic 4: Biomes (Chapter 4)*

1. Define and relate climate and weather and describe the effect of latitude on climate.
2. Describe the major land biomes.

*Topic 5: Population Dynamics (Chapter 5)*

1. Define population density.
2. Explain why population growth is affected by birth rate, death rate, immigration, and emigration.
3. Explain why populations could grow exponentially, but usually do not.
4. Describe how the logistic growth pattern relates to carrying capacity.
5. Compare and contrast J curves and S curves of population growth (handout).
6. Explain how density-dependent limiting factors (competition, predation, parasitism, disease) control population growth.
7. Explain how density-independent limiting factors control population growth.
8. Examine human population using age-structure diagrams.
9. Define sustainability and provide examples of how it can be achieved by humans (144-149).

**Key Vocab/Concepts**

|  |  |  |
| --- | --- | --- |
| Ecology | Biogeochemical cycles | Ecological succession |
| Species | Evaporation | Primary succession |
| Population | Transpiration | Pioneer species |
| Community | Water cycle | Secondary succession |
| Ecosystem | Nutrients | Climax community |
| Biome | Carbon cycle | Estuary |
| Biosphere | Nitrogen cycle |  |
| Heterotroph | Nitrogen fixation | Population density |
| Autotroph | Denitrification | Immigration |
| Producer | Phosphorus cycle | Emigration |
| Photosynthesis |  | Exponential growth |
| Chemosynthesis | Primary productivity | Logistic growth |
| Consumer | Limiting nutrient | Carrying capacity |
| Herbivore | Climate | Limiting factor |
| Carnivore | Weather | Density-dependent limiting factor |
| Detrivore | Biotic factor | Density-independent limiting fact. |
| Decomposer | Abiotic factor | Age-structure diagram |
| Omnivore | Habitat | Sustainable development |
| Food chain | Niche | Invasive species |
| Food web | Resource |  |
| Trophic level | Competitive exclusion principle |  |
| Ecological pyramids | Predation |  |
| 10% rule | Symbiosis |  |
| Biomass | Mutualism |  |
| Biological magnification | Commensalism |  |
|  | Parasitism |  |

**Assessment Evidence**

Environmental Issue PPT presentation

Random sampling lab

Unit quiz

Unit test

Objectives

**Learning Plan Period 5**

|  |  |  |
| --- | --- | --- |
| **Day** | **In Class Activity** | **Homework** |
| Mon 10/3B day | No class |  |
| Tues 10/4C day | Go over unit 1 test. Intro unit | Unit 2 Obj 1-5 |
| Wed 10/5D day | Basic ecology termsIntro ppt project  | Obj 6-9 |
| Thur 10/6E day | Basic ecology terms There’s a Hair in my soup | Obj 10-13 |
| Fri 10/7F day | Energy flow through ecosystemsFood webs vs. pyramids | Obj 14-18 |
| Mon 10/10 | Columbus Day |  |
| Tues 10/11A day | Biological MagnificationCommunity Ecology | Study for quiz |
| Wed 10/12B day | No Class |  |
| Thur 10/13C day | **Quiz obj 1-10, 13-16**Intro to invasive species | Plant lab |
|  Fri 10/14D day | Invasive SpeciesSuccession **Plant lab due** | Obj 21-23Work on PPT Project |
| Mon 10/17E day | Nutrient CyclesLimiting Factors | Obj 24-26Work on PPT Project |
|  Tues 10/18F day | Random Sampling Lab | Obj 27-29Work on PPT Project |
| Wed 10/19A day | Population EcologyHuman effect on environment | Work on PPT Project |
| Thur 10/20B day | No Class |  |
| Fri 10/21C day | PPT Presentations | Work on Lab ReportStudy for test |
| Mon 10/24D day | PPT Presentations | Study for test |
| Tues 10/25E day | Catch Up/Review for Test | Study for test |
| Wed 10/26F day | **Unit 2 Test** | Obj 1-6 Unit 3 |

**Learning Plan Period 6**

|  |  |  |
| --- | --- | --- |
| **Day** | **In Class Activity** | **Homework** |
| Mon 10/3B day | Go over unit 1 test. Intro unit | Unit 2 Obj 1-5 |
| Tues 10/4C day | Basic ecology termsIntro ppt project  | Obj 6-9 |
| Wed 10/5D day | Basic ecology terms There’s a Hair in my soup | Obj 10-13 |
| Thur 10/6E day | Energy flow through ecosystemsFood webs vs. pyramids | Obj 14-18 |
| Fri 10/7F day | Biological MagnificationCommunity Ecology | Study for quiz |
| Mon 10/10 | Columbus Day |  |
| Tues 10/11A day | No Class |  |
| Wed 10/12B day | **Quiz obj 1-10, 13-16**Intro to invasive species | Plant lab |
| Thur 10/13C day | Invasive SpeciesSuccession **Plant lab due** | Obj 21-23Work on PPT Project |
|  Fri 10/14D day | Nutrient CyclesLimiting Factors | Obj 24-26Work on PPT Project |
| Mon 10/17E day | Random Sampling Lab | Obj 27-29Work on PPT Project |
|  Tues 10/18F day | Population EcologyHuman effect on environment | Work on PPT Project |
| Wed 10/19A day | No class |  |
| Thur 10/20B day | PPT Presentation | Work on Lab ReportStudy for test |
| Fri 10/21C day | PPT Presentations | Study for test |
| Mon 10/24D day | PPT Presentations | Study for test |
| Tues 10/25E day | Catch Up/Review for Test | Study for test |
| Wed 10/26F day | **Unit 2 Test** | Obj 1-6 Unit 3 |