

Science
Environmental Geoscience
Unit 2: The Biosphere

Essential Understandings	▪ Causation: Nothing “just happens”. Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ Why is the biosphere important to Earth? ▪ What is the biosphere? ▪ How has the biosphere influenced other Earth systems through time? ▪ What sub-systems exist within the biosphere? In what ways are they interrelated? ▪ How is the world’s population effected by the biosphere system? ▪ What political and economic controversies exist related to the biosphere?
Essential Knowledge	▪ The biosphere influences the atmosphere, hydrosphere, and lithosphere. ▪ A historical record of the biosphere has been preserved in the rock record. ▪ Most of the biosphere exists in a very thin zone on Earth. ▪ A food chain exists on land and in the ocean. ▪ The biosphere is in a delicate balance, and people influence that balance daily.
Vocabulary	▪ <u>Terms:</u> ○ biosphere, food chain, flora and fauna, photosynthesis, nutrient cycles, habitat, ecosystem, bacteria, succession, biome, carrying capacity
Essential Skills	▪ Explain the interactions among the biosphere and lithosphere. ▪ Explain a political and/or economic controversy related to the biosphere and give ideas for resolving that controversy.
Related Maine Learning Results	<u>Science and Technology</u> A. Unifying Themes A1. Systems Students apply an understanding of systems to explain and analyze man-made natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system’s relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system.

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Related Maine Learning Results	D. The Physical Setting D2. Earth Students describe and analyze the biological, physical, energy, and human influences that shape and alter Earth Systems. a. Describe and analyze the effect of solar radiation, ocean currents, and atmospheric conditions on the Earth's surface and the habitability of Earth. b. Describe Earth's internal energy sources and their role in plate tectonics. c. Describe and analyze the effects of biological and geophysical influences on the origin and changing nature of Earth Systems. d. Describe and analyze the effects of human influences on Earth Systems.
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Related Maine Learning Results	D3. Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions. c. Explain the essential roles of carbon and water in life processes. d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules). f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. g. Describe nuclear reactions, including fusion and fission, and the energy they release. h. Describe radioactive decay and half-life. i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction. k. Apply an understanding of energy transformations to solve problems. l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.
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Related Maine Learning Results	E. The Living Environment E1. Biodiversity Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity. - Explain how the variation in structure and behavior of a population of organisms may influence the likelihood that some members of the species will have adaptations that allow them to survive in a changing environment. - Describe the role of DNA sequences in determining the degree of kinship among organisms and the identification of species. - Analyze the relatedness among organisms using structural and molecular evidence. - Analyze the effects of changes in biodiversity and predict possible consequences. E2. Ecosystems Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change. - Explain why ecosystems can be reasonably stable over hundreds or thousand of years, even though populations may fluctuate. - Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations. - Explain the concept of carrying capacity and list factors that determine the amount of life that any environment can support. - Describe the critical role of photosynthesis and how energy and the chemical elements that make up molecules are transformed in ecosystems and obey basic conservation laws.
Sample Lessons And Activities	▪ Fossils Laboratory (identifying hand samples of fossils, paleohabitat, and formation environment). ▪ Library Research Project (Topic: A proposal to address the largest man-made threat to wildlife in the Chesapeake Bay.)
Sample Classroom Assessment Methods	▪ Quizzes on class lectures ▪ Laboratory and project grades ▪ Presentation of Chesapeake Bay research and proposal ▪ Examination at the end of unit

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Sample Resources	▪ <u>Publications</u> ○ “Fossils, A Guide to Prehistoric Life,” Frank H. T. Rhodes et al., Golden Press, New York: 1962. ▪ <u>Other Resources:</u> ○ Science Resource Center (Library online database)
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