**Dust Bowl**

**Benchmarks:**

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| SC.912.L.17.9 | Use a food web chain to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.  |
| SC.912.L.17.4 | Describe changes in ecosystems resulting from seasonal variations, climate change, and succession. |
| SC.912.L.17.5 | Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity. |
| SC.912.L.17.8 | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, nonnative species. |
| SC.912.L.17.13 | Discuss the need for adequate monitoring of environmental parameters when making policy decisions. |
| SC.912.L.17.20 | Predict the impact of individuals on environmental systems, and examine how human lifestyles affect sustainability |
| SC.912.L.18.1 | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules. |
| SC.912.N.1.1 | Define a problem based on a specific body of knowledge and do the following:1. Pose questions about the natural world;
2. Conduct systematic observations
3. Examine books and other sources of information to see what is already known
4. Review what is known in light of empirical evidence
5. Plan investigations
6. Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)
7. Pose answers, explanations, or descriptions of events
8. Generate explanations that explicate or describe natural phenomena (inferences)
9. Use appropriate evidence and reasoning to justify these explanations to others
10. Communicate results of scientific investigations

11. Evaluate the merits of the explanations produced by others |
| SC.912.N.1.3 | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |

**Relevant Achievement Level Descriptions**

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| Analyze data/information about population dynamics and limiting factors to explain changes in carrying capacity, population size, and distribution of species. |
| Analyze the energy pathways through different trophic levels in a food web or energy pyramid. |
| Predict potential changes to an ecosystem resulting from seasonal variations, climate changes, and succession |
| Predict positive and/or negative consequences that may result from a reduction in biodiversity |
| Predict how human activity impacts environmental systems and affect sustainability in the short and long term. |
| Summarize basic molecular structure and function of carbohydrates, lipids, proteins, and ~~nucleic acids.~~ |

**Students should be able to:**

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| **Know** | **Understand** |
| The Dust Bowl is known as an ecological catastrophe that coincided with the Great Depression.The Dust Bowl created awareness that environmental parameters must be considered and should influence policy decisions. | Both environmental and human factors contributed to the Dust Bowl.How the Dust Bowl impacted policy decisions in its aftermath |
| Limiting factors, such as the availability of fertile land, water, etc. impact the carrying capacity, population size, and distribution of species in an ecosystem. | Water is the limiting factor that should drive the management decisions in this scenario. |
| Trophic levels include producers (first), herbivores (second), omnivores (third), and carnivores (fourth). | Available energy decreases as you move from the first trophic level to subsequent levels. A reduction in organisms in a trophic level has impacts on organisms in other trophic leve.ls. |
| Ecological succession is a series of gradual changes that occur in a community following a disturbance. Succession ends when the community has reached climax, where in the absence of additional disturbances, is stable and relatively unchanged. Biomes are climax communities. | The climatic conditions and farming practices during the Dust Bowl generated a disturbance in ecological communities, which resulted in secondary succession. The United States Great Plains are considered to be a temperate grassland biome, whose communities have reached climax. |
| There are four biological macromolecules, three of which are introduced in this lesson, including: carbohydrates, lipids (fats), and proteins. | These biological macromolecules are essential for the proper function of the human body. One’s diet should consist of a balance of these macromolecules. |

 **Carbon & Water Cycle**

**Benchmarks:**

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| SC.912.E.7.1 | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon  |

**Relevant Achievement Level Descriptions**

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| Analyze the movement of matter through different biogeochemical cycles |

**Plants & Biogeochemical Cycles**

**Benchmarks:**

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| SC.912.L.14.2 | Relate structure to function for the components of plant ~~and animal cells~~. Explain the role of cell membranes as a highly selective barrier (passive and active transport). |
| SC.912.L.14.7 | Relate the structure of each of the major plant organs and tissues to physiological processes. |
| SC.912.L.18.7 | Identify the reactants, products, and basic functions of photosynthesis. |
| SC.912.L.18.11 | Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity. |
| SC.912.L.18.12 | Discuss the special properties of water that contribute to Earth’s suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing, and versatility as a solvent. |
| SC.912.E.7.1 | Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon. |
| SC.912.N.1.1 | Define a problem based on a specific body of knowledge and do the following:1. Pose questions about the natural world;
2. Conduct systematic observations
3. Examine books and other sources of information to see what is already known
4. Review what is known in light of empirical evidence
5. Plan investigations
6. Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)
7. Pose answers, explanations, or descriptions of events
8. Generate explanations that explicate or describe natural phenomena (inferences)
9. Use appropriate evidence and reasoning to justify these explanations to others
10. Communicate results of scientific investigations
11. Evaluate the merits of the explanations produced by others
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**Relevant Achievement Level Descriptions**

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| Compare structures and describe related functions in different types of cells |
| Relate structures of plant tissues and organs directly to their roles in physiological processes (photosynthesis and transpiration) |
| Analyze how enzymes speed up the rate of a biochemical reaction and describe the effect of environmental factors on enzyme activity |
| Summarize the properties of water and analyze how these properties make water essential for life on Earth. |
| Analyze the movement of matter through different biogeochemical cycles (water cycle and carbon cycle) |
| Interpret, analyze, and synthesize data to determine causal relationships in a complex investigation |
| Evaluate the reliability of other sources of information to make predictions and defend conclusions based on experimental design or scientific argumentation |

**Students should be able to:**

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| **Know** | **Understand** |
| Plants are autotrophic (produce their own food) | Plants undergo the chemical reaction photosynthesis to produce their own food. Photosynthesis rely on carbon dioxide and water as reactants, therefore photosynthesis is a player in both the carbon and water cycle. |
| Plants utilize only about 1% of the water taken in at the roots for photosynthesis. The other 99% evaporates at the leaf surface in a process called transpiration. | Transpiration is an important player in the hydrologic (water) cycle, which returns water from the soil to the atmosphere.Transpiration is impacted by both environmental factors and the plant’s anatomical features.  |
| Plants have specialized cells, tissues, and organs that assist in the processes of photosynthesis and transpiration. | Students should understand the structure and function of plant organs, including: roots, stems, and leaves.Students should understand the structure and function of plant tissues including: dermal, ground, and vascular. Students should be able to cite examples of each tissue type in the roots, stems, and leaves.Students should identify the types of cells found in plant tissues, including: parenchyma, sclerenchyma, and collenchyma. Students should be able to cite examples of each cell type in the roots, stems, and leaves.Students should relate plant structure and function to transpiration and photosynthesis, and hence the hydrologic and carbon cycles. |
| Water processes (osmosis, transpiration) and properties (solvent, surface, tension, cohesion, adhesion) contribute to movement of water through a plant. | Students should relate these processes and properties to movement of water through xylem in a plant, which is required for photosynthesis and transpiration. |

**Cellular Respiration**

**Benchmarks:**

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| SC.912.L.18.1  | A. All living things are composed of four basic categories of macromolecules and share the same basic needs for life.B. Living organisms acquire the energy they need for life processes through various metabolic pathways (primarily photosynthesis and cellular respiration).C. Chemical reactions in living things follow basic rules of chemistry and are usually regulated by enzymes. |
| SC.912.L.18.2  | Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things. |
| [SC.912.L.18.8](http://www.cpalms.org/Standards/PublicPreviewBenchmark2051.aspx)  | Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration. |
| [SC.912.L.18.9](http://www.cpalms.org/Standards/PublicPreviewBenchmark2052.aspx)  | Explain the interrelated nature of photosynthesis and cellular respiration. |
| SC.912.L.18.12  | Discuss the special properties of water that contribute to Earth’s suitability as an environment for life: cohesive behavior, ability to moderate temperature, expansion upon freezing~~,~~ and versatility as a solvent. |
| [SC.912.N.1.3](http://www.cpalms.org/Public/PreviewStandard/Preview/1858)  | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |
| [SC.912.L.18.10](http://www.cpalms.org/Standards/PublicPreviewBenchmark2053.aspx)  | Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell. |
| [SC.912.N.1.1](http://www.cpalms.org/Public/PreviewStandard/Preview/1856)  | Define a problem based on a specific body of knowledge and do the following: Pose questions about the natural world;Conduct systematic observationsExamine books and other sources of information to see what is already knownReview what is known in light of empirical evidencePlan investigationsUse tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)Pose answers, explanations, or descriptions of eventsGenerate explanations that explicate or describe natural phenomena (inferences)Use appropriate evidence and reasoning to justify these explanations to othersCommunicate results of scientific investigationsEvaluate the merits of the explanations produced by others |

**Relevant Achievement Level Descriptions**

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| Interpret, analyze, and synthesize data to determine causal relationships in a complex investigation |
| Use scientific reasoning to justify abstract explanations |
| Make sound scientific inferences based on natural phenomena |
| Cite evidence for how the processes of photosynthesis and cellular respiration are interrelated |
| Compare the processes of aerobic and anaerobic respiration  |
| Connect the role of ATP to energy transfers within the cell  |

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| **Know** | **Understand** |
| All life uses respiration to release energy from food | Respiration is related to photosynthesis in that the products of one are the reactants of the other |
| Aerobic respiration uses oxygen, while anaerobic does not | Aerobic respiration is more efficient than Anaerobic respiration |
| ATP is a universal energy carrier used by cells | ATP stores energy in the bonds between the second and third phosphates |
| Macromolecules vary in structure. | Carbohydrates are the preferred source of energy in respiration |

**Plants and Energy**

**Benchmarks:**

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| SC.912.L.18.9 | Explain the interrelated nature of photosynthesis and cellular respiration  |
| SC.912.18.7 | Identify the reactants, products, ~~and~~ ~~basic functions~~ of photosynthesis |
| SC.912.L.18.8 | Identify the reactants, products, ~~and~~ ~~basic functions~~ of ~~aerobic and anaerobic~~ cellular respiration |
| SC.912.N.1.1 | Define a problem based on a specific body of knowledge and do the following:1. Pose questions about the natural world;
2. Conduct systematic observations
3. Examine books and other sources of information to see what is already known
4. Review what is known in light of empirical evidence
5. Plan investigations
6. Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)
7. Pose answers, explanations, or descriptions of events
8. Generate explanations that explicate or describe natural phenomena (inferences)
9. Use appropriate evidence and reasoning to justify these explanations to others
10. Communicate results of scientific investigations
11. Evaluate the merits of the explanations produced by others
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| SC.912.N.1.3 | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |
| SC.912.N.1.6 | Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied |

**Relevant Achievement Level Descriptions:**

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| Formulate how the processes of photosynthesis and cellular respiration are interrelated |
| Interpret, analyze, and synthesize data to determine causal relationships in complex investigation |
| Evaluate the reliability of other sources of information, to make predictions and defend conclusions based on experimental design or scientific argumentation |
| Use scientific reasoning to justify abstract explanations |
| Make sound scientific inferences based on natural phenomena |

**Benchmarks not addressed in exemplar lessons:**

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| [SC.912.L.17.11](http://www.cpalms.org/Public/PreviewStandard/Preview/2039)  | Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests. | EOC with SC.912.L.17.20 |
| [SC.912.L.17.16](http://www.cpalms.org/Public/PreviewStandard/Preview/2041)  | Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution. | Honors extension. Not directly assessed |
| SC.912.L.17.2 | Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature. | EOC with SC.912.L.17.5 |
| SC.912.L.18.3 | Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes. | Honors extension. Not directly assessed |
| [SC.912.L.18.4](http://www.cpalms.org/Public/PreviewStandard/Preview/2047)  | Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes. | Honors extension. Not directly assessed |