



**Biology Frameworks Pacing Guide  
Stability and Change in Ecosystems**

**Crosscutting Concepts:** Scale, Proportion, and Quantity; Matter and Energy; Stability and Change

**Topics:** Biomes and Adaptations; Human Population; Human Impact on Land Use; Human Impact on Agriculture; Community Interactions; Adapting to Changing Environments

7-week Instructional Segment

Anchoring Phenomenon	GSE	Sample Instructional Segment	Disciplinary Core Ideas	Science and Engineering Practices	Instructional Notes
<p>Human activities can cause major shifts in ecosystems. For example, desertification is causing global impacts.</p> <p>Resources: TED: This <a href="#">TEDTalks video</a> highlights global human impact resulting in desertification.</p> <p>Information regarding events that have shaped Georgia’s environmental history, practices,</p>	<p><b>SB2. c</b> <b>SB5. a,</b> c, d, e</p>	<p><b>Human Population: We are the World</b> Increasing human population affects ecosystems and availability of limited resources.</p> <p><b>Natural Impact on Ecosystems and Biodiversity: Can’t We All Just Get Along?</b> Geological records confirm the Earth is constantly changing and causes different plant and animal adaptations that increase fitness in the changing environment to get</p>	<p>From <i>A Framework for K-12 Science Education: By the end of grade 12</i></p> <p><b>LS2A: Interdependent Relationships in Ecosystems</b></p> <ul style="list-style-type: none"> <li>• Ecosystems have carrying capacities that limit the number of organisms and populations they can support.</li> <li>• Limiting factors include the availability of living and nonliving resources and challenges as predation, competition, and disease.</li> <li>• Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite.</li> <li>• Limiting factors affect the abundance of species in any given ecosystem.</li> </ul> <p><b>LS2B: Cycles of Matter and Energy Transfer in Ecosystems</b></p> <ul style="list-style-type: none"> <li>• Photosynthesis and cellular respiration provide most of the energy for life processes.</li> <li>• Plants or algae form the lowest level of the food web.</li> <li>• At each link upward in a food web, only a</li> </ul>	<p>Obtaining, evaluating, and communicating information</p> <p>Planning and carrying out investigations</p> <p>Engaging in argument from evidence</p> <p>Designing solutions</p> <p>Asking questions and defining problems</p>	<p>Additional notes on topic, focus, and phenomena can be found within instructional segments.</p> <p>By the end of this unit, students are using the following language in their speaking and writing during EXPLAIN or ELABORATE:</p> <ul style="list-style-type: none"> <li>• Photosynthesis and cellular respiration</li> <li>• Energy and matter</li> <li>• Biotechnology</li> <li>• Interdependence</li> <li>• Ecosystems</li> <li>• Populations</li> <li>• Biodiversity</li> <li>• Food webs and energy pyramids</li> </ul>

<p>and laws</p> <p><b>By the end of this unit, students will explain the phenomenon using the following concepts:</b></p> <p>Plants and animals have different adaptations that increase fitness in different biomes.</p> <p>Increasing human populations requires the use of more limited resources.</p> <p>Misuse of these resources may result in an increase of carbon in the atmosphere, causing climate change.</p> <p>Improper farming practices in areas with high biodiversity may</p>		<p>passed to offspring.</p>	<p>small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level.</p> <ul style="list-style-type: none"> <li>• There are generally fewer organisms at higher levels of a food web, and there is a limit to the number of organisms an ecosystem can sustain.</li> <li>• The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil and are combined and recombined in different ways.</li> <li>• At each link in an ecosystem, matter and energy are conserved; some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded.</li> <li>• Competition among species is ultimately competition for the matter and energy needed for life.</li> <li>• Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged between the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.</li> </ul> <p><b>LS2C: Ecosystem Dynamics, Functioning, and Resilience</b></p> <ul style="list-style-type: none"> <li>• A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant under stable conditions.</li> </ul>		<ul style="list-style-type: none"> <li>• Cycling of biochemical elements</li> <li>• Environmental stability and change</li> <li>• Human impacts</li> <li>• Survival within changing environmental limits</li> </ul>
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<p>have drastic effects on the soil, plants, and water.</p> <p>These areas can experience desertification, affecting plants and animals native to the biome.</p> <p>Plants and animals must adapt to human or naturally induced changing ecosystems.</p> <p>Conservation efforts may help slow or reverse the negative effects of humans on ecosystems.</p>			<ul style="list-style-type: none"> <li>● If a modest disturbance to an ecosystem occurs, it may return to its more or less original status instead of becoming a very different ecosystem.</li> <li>● Extreme fluctuations in conditions or the size of any population can challenge the functioning of ecosystems in terms of resources and habitat availability.</li> <li>● Human activity in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.</li> </ul> <p><b>LS4D: Biodiversity and Humans</b></p> <ul style="list-style-type: none"> <li>● Human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change.</li> <li>● These activities can cause a major wave of extinctions as many species or populations of a given species are unable to survive in changed environments and die out.</li> <li>● Sustaining biodiversity is essential to supporting and enhancing life on Earth.</li> </ul>		
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This instructional segment will connect to SB3 in Patterns in Heredity and Selection and SB6 in Stability and Change in Populations Over Time by connecting animal and plant adaptations that increase fitness in particular ecosystems can be passed to successive generations. It will also connect to SB2 in Structure and Function of Molecular Genetics by connecting the idea that natural selection occurs based on random genetic variations that code for traits that may increase fitness. It will also connect to SB4 in Patterns in Living Systems with the cycling of matter and energy through producers and consumers in ecosystems.