

# The Biosphere

Suggested Pacing: Approximately 5-7 Blocks

## Topics at a Glance:

- What makes up the biosphere?
- The interconnectedness of living things.
  - Food Webs
  - Biomagnification
- The importance of Biodiversity.
- A look at prior and current Mass Extinction events.

## Stage 1 – Desired Results

### Performance Expectations: (PE) (Established Goals / Content Standards)

- Construct an explanation based on evidence for how the availability of natural resources in the biosphere, occurrence of biological hazards, or other biological changes have affected human activity. (HS-ESS3-1)
- Use principles of population dynamics to evaluate the claim that the rate of change modeled over short and long periods of time indicates that the human population has reached the carrying capacity determined by the availability of living and nonliving resources. (HS-ESS3-3)
- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.\* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.] (HS-LS2-7)

### Enduring Understandings (1-3 max)

Students will understand that:

- The survival of all living things is dependent upon a sustainable balance of finite resources and complex interactions.
- Stability and change in the biosphere are directly related to the resources and interactions that exist in the system.
- The scale and proportion of human impacts in the biosphere depends upon the magnitude of the impact and the sensitivity of the ecosystem.

### Essential Questions (1-2 EQ per EU)

1. What is the biosphere and how do humans utilize it?
2. To what extent can individual decisions and societal decisions impact the biosphere and our planet's life support system (environment) overall?
3. What solutions and or improvements can humans make to mitigate negative impacts on the biosphere and move toward sustainability?

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Bolded SEP's are a suggested focus for this unit.</b></p> <ul style="list-style-type: none"> <li>● Ask questions and define problems</li> <li>● Develop and use models</li> <li>● Plan and carry out investigations</li> <li>● Analyze and interpret data</li> <li>● Use mathematics and computational thinking</li> </ul>	<p><b>ESS3.A: Natural Resources</b></p> <ul style="list-style-type: none"> <li>● Resource availability has guided the development of human society. (HS-ESS3-1)</li> </ul> <p><b>ESS3.C: Human Impacts on Earth Systems</b></p> <ul style="list-style-type: none"> <li>● Human Impacts on Earth Systems - The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)</li> </ul> <p><b>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</b></p> <ul style="list-style-type: none"> <li>● A complex set of interactions within an</li> </ul>	<p><b>Bolded CC's are a suggested focus for this unit.</b></p> <ul style="list-style-type: none"> <li>● Patterns</li> <li>● <b>Cause &amp; Effect: Mechanism &amp; Explanation</b></li> <li>● <b>Scale, Proportion, &amp; Quantity</b></li> <li>● Systems &amp; System Models</li> </ul>

<ul style="list-style-type: none"> <li>● <b>Construct explanations and design solutions</b></li> <li>● Engaging in argument from evidence</li> <li>● <b>Obtaining, evaluating and communicating information</b></li> </ul>	<p>ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-7)</p>	<ul style="list-style-type: none"> <li>● <b>Energy &amp; Matter: Flow, Cycle, Conservation</b></li> <li>● Structure &amp; Function</li> <li>● <b>Stability &amp; Change</b></li> </ul>
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**Stage 2 – Model Assessments**

<p><b>Summative Performance Task(s)</b></p> <ul style="list-style-type: none"> <li>● Calculating and Analyzing your Eco Footprint:       <ol style="list-style-type: none"> <li>1. Students will identify something locally or personally that in some way has a negative impact on the biosphere. (Invasive species, habitat destruction, changing land cover or use, landscaping effect on local plant and animal biodiversity, etc.</li> <li>2. Students will highlight the pros and cons of the chosen topic including environmental and non environmental components.</li> <li>3. Students will highlight existing solutions and or propose new ones that maximize pros, minimize cons and work toward sustainability.</li> </ol> </li> </ul>	<p><b>Formative Assessments:</b></p> <ul style="list-style-type: none"> <li>● Student worksheets</li> <li>● Checkpoint questions and submissions.</li> <li>● Formative quizzes</li> <li>● Teacher conferences and check-in's</li> <li>● Student self-assessment &amp; reflection</li> </ul>
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**Stage 3 – Learning Plan / Road Map (Design to make as student-centered as possible)**

<p><b>Suggested Resources for Planning:</b></p> <p>Earth Viewer for comparing biodiversity during past mass extinctions and now in the 6th mass extinction  <a href="https://www.biointeractive.org/classroom-resources/earthviewer">https://www.biointeractive.org/classroom-resources/earthviewer</a></p> <p>Population growth and carrying capacity interactive  <a href="https://learn.concord.org/resources/102/african-lions-modeling-populations">https://learn.concord.org/resources/102/african-lions-modeling-populations</a></p> <p>Antarctic Food Web Game  <a href="https://nj.pbslearningmedia.org/resource/lsp07.sci.life.eco.oceanfoodweb/antarctic-food-web-game/">https://nj.pbslearningmedia.org/resource/lsp07.sci.life.eco.oceanfoodweb/antarctic-food-web-game/</a></p> <p>Withgott, J., Wiggins, G. P., Lisowski, M., Scotchmoor, J., Thanukos, A., &amp; Pearson Education, Inc. (2011).        Pearson environmental science: Your world, your turn. Boston, Mass: Pearson.</p>
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<p><b>Learning Activities:</b></p> <p>Ecological Footprints and Decision Making</p> <ul style="list-style-type: none"> <li>● Evaluate human demands on natural resources.</li> <li>● Compare the ecological footprint of someone living in a developed versus a developing/third world country; describe the reasons why the footprint is different. Discuss needs and wants as they relate to</li> </ul>
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ecological footprints.

- Discuss the “Tragedy of the Commons” as an example of individual decisions affecting group results and how this concept relates to environmental science.
- Relate ecosystem services to environmental commons and decisions made about private and public property.
- Use decision making models and processes including cost/benefit analysis and show ethical considerations fit into decision making.
- Develop an understanding of sustainability, and ways in which humans can reduce their impact on ecosystems and watersheds.
- Argue from evidence that urbanization is either a net positive or net negative for ecological footprints of individuals and populations.

#### Major Issues in Environmental Science

- Use risk assessment to evaluate environmental issues, and set priorities for decision making
- Examine some of the most pressing environmental issues in relation to their prevalence and importance in New Jersey. These include: land use and loss/degradation of habitat, invasive species, wetland loss.