

## What if...? Modeling Bald Eagle Habitats *Teacher Notes*

### Unit Overview

In this fifth grade NGSS-aligned unit, students use observations from the Duke Farms eagle webcam and a visit to Duke Farms (or a similar location) to construct a systems model of a bald eagles' habitat. This model will include biotic and abiotic elements of the ecosystem, show the relationships between the organisms in terms of what they consume or decompose, and demonstrate balance within the ecosystem. Students will then use their models to determine what could, once again, threaten eagles with extinction. They will develop plans to ensure the bald eagles maintain a thriving population and select an appropriate audience with which to share their plans.

### Next Generation Science Performance Expectations Addressed

**5-LS2-1** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

**Clarification Statement:** Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth. Assessment Boundary: Assessment does not include molecular explanations.

**5-PS3-1** Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

**Clarification Statement:** Examples of models could include diagrams and flow charts.

**5-ESS3-1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

**3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

### NGSS Science and Engineering Practices Addressed

#### Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

[Develop a model to describe phenomena. \(5-LS2-1\)](#)

### NGSS Crosscutting Concepts Addressed

#### Systems and System Models

A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

[A system can be described in terms of its components and their interactions. \(5-LS2-1\)](#)

### Enduring Understandings

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- The food of almost any kind of animal can be traced back to the sun.
- Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.
- Organisms can survive only in environments in which their particular needs are met.

### Essential Questions

- How and why do organisms interact with their environment and what are the effects of these interactions?
- What happens to ecosystems when the environment changes?
- What is the process for developing potential design solutions?

- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life.
- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others adapt to the transformed environment, and some die.
- Research on a problem should be carried out before beginning to design a solution.

## 21<sup>st</sup> Century Skills Addressed

### *Core Content and Interdisciplinary Themes*

- Global Awareness
- Civic Literacy
- Environmental Literacy

### *Learning and Innovation*

- Critical Thinking and Problem Solving
- Creativity and Innovation
- Communication and Collaboration

### *Information and Media Literacy*

- Information Literacy
- Information and Communication Technology

### *Life and Career*

- Initiative and Self Direction
- Productivity and Accountability
- Leadership and Responsibility
- Flexibility and Adaptability

## Teacher Resources

- [Duke Farms Eagle Cam](#)
- [Duke Farms' Bald Eagles e-book](#) by Jim Wright. This user-friendly resource contains information about bald eagles in general, and the eagles at Duke Farms in particular. Excellent pictures from all stages of eagle growth and of eagle banding, habitat, and cultural importance.
- [Duke Farms Eagle Cam Blog](#), maintained by Jim Wright
- Check in with Duke Farms for "[Using Eagle Cam in the Classroom](#)" [Professional Development workshops](#) each January and on their Facebook [Eagle Cam Teacher Page](#)
- [Teacher Blog on Duke Farms' eagles](#) by Diane Cook, 2015 winner of Duke Farms Eagle Cam Lesson Plan Contest.
- Conserve Wildlife Foundation [eagle lesson plan database](#)
- [Duke Farms Eagle Cam FAQs](#)
- [NJ Bald Eagle Field Guide](#)
- [Bald Eagles in the Meadowlands and Beyond e-book](#) by Jim Wright. Information about bald eagles' comeback in New Jersey and beyond.
- [Bald Eagle Fact Sheet](#)
- Cornell Lab of Ornithology [BirdSleuth K-12](#), created to "inspire investigations through outdoor observations and citizen science."

## What if...? Modeling Bald Eagle Habitats

The bald eagle, a national symbol of the United States, is a conservation success story. Approximately fifty years ago, illegal eagle hunting, habitat destruction, and toxins in pesticides nearly destroyed eagle populations. In response, bald eagles were one of the first species to be declared endangered under the Endangered Species Act (ESA), and Congress passed a specific law that made killing bald eagles illegal. This regulation, along with the habitat protection funded by the ESA and the federal government's ban on certain pesticides, prevented the bald eagle from becoming extinct. The bird has made a remarkable comeback and is now thriving in the United States.



Conservation organizations, like Duke Farms of Hillsborough, New Jersey, protect and restore native wildlife and the habitats on which they depend. Because some habitats are very sensitive to human disturbance, one of the best ways for scientists to gather data is through web cameras. The Duke Farms eagle webcam, installed above an active bald eagle nest, is a tool that allows scientists and the rest of us to take a deeper look at the needs and behavior of the bald eagle.

Is it possible the bald eagle could be again threatened with extinction? Observe the Duke Farms eagle cam feed or, depending on season, archived footage of the eagles. After careful observation and data collection, determine the factors that sustain a bald eagle population. Create a model of the ecosystem that begins with the sun as the source of food for the bald eagle. Show the interdependencies among the biotic and abiotic parts of the ecosystem allow it to sustain balance. What are possible disruptions to the ecosystem? Use your research to determine the extent to which the bald eagle could be threatened in the future.

With this information, find a way to make a difference for the future of the bald eagles of New Jersey. Identify an audience that can support your actions and ideas. Present your scientific argument, outlining the actions that should be taken to prevent threats to bald eagles. It could be a letter to a legislator proposing the institution of a new policy, or a letter to an organization that identifies the possible threats that they are posing to the eagle population. Use your efforts to ensure that the possibility of extinction doesn't happen again.

## What If...? Modeling Eagle Habitats *Rubric*

Criteria	Novice	Apprentice	Practitioner	Expert
<b>Eagle Observation and Research</b>	<ul style="list-style-type: none"> <li>accesses eagle cam to collect data</li> <li>brainstorms eagle needs</li> </ul>	<ul style="list-style-type: none"> <li>collects and records data from the eagle cam</li> <li>gathers information about eagle needs from digital or print sources</li> </ul>	<ul style="list-style-type: none"> <li>collects, records, categorizes, and interprets data from the eagle cam</li> <li>gathers information about eagle needs from multiple digital and print sources</li> <li>identifies how Duke Farms uses scientific ideas to protect the environment</li> </ul>	all of Practitioner, plus identifies additional local organizations that, like Duke Farms, are committed to protecting natural resources
<b>Components of an Ecosystem</b>	<ul style="list-style-type: none"> <li>lists plant and animal ecosystem components</li> <li>identifies how energy flows between organisms</li> <li>lists one effect humans have on an ecosystem</li> </ul>	<ul style="list-style-type: none"> <li>identifies plant and animal ecosystem components by place in food web</li> <li>identifies factors that determine the types of plants or animals that can survive in an ecosystem</li> <li>describes how energy from the sun enters ecosystem</li> <li>lists multiple effects humans have on an ecosystem</li> <li>compares and contrasts needs of plants and animals across ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>identifies plant, animal, and decomposers in ecosystem by place in food web</li> <li>draws conclusions about the biotic and abiotic factors that determine the types of plants or animals that can survive in an area</li> <li>describes the flow of energy from the sun to show how organisms obtain energy</li> <li>explains positive and negative effects humans have on an ecosystem</li> <li>identifies patterns of plants and animals across ecosystems</li> </ul>	all of Practitioner, plus analyzes the concept of natural selection in an ecosystem and how it applies to the bald eagle population
<b>Model</b>	<ul style="list-style-type: none"> <li>describes purpose of an ecosystem model</li> <li>names one change that could take place in the bald eagles' ecosystem and identifies the affect it would have</li> <li>defines the law of conservation of energy</li> </ul>	<ul style="list-style-type: none"> <li>identifies ecosystem elements to include in model</li> <li>organizes ecosystem elements into logical categories</li> <li>provides an example of how changing an aspect of the ecosystem will affect other aspects of the ecosystem</li> <li>explains the law of conservation of energy</li> </ul>	<ul style="list-style-type: none"> <li>constructs a model of an eagles' ecosystem including the transfer of energy between plants, animals, decomposers, and the abiotic environment</li> <li>synthesizes how the interdependent elements of the bald eagles' habitat create an ecosystem</li> <li>provides multiple examples of how changing one aspect of the ecosystem will affect other aspects of the ecosystem</li> <li>explains how the law of conservation of energy relates to energy flow within the bald eagles' ecosystem</li> </ul>	all of Practitioner, plus utilizes technology to develop the model

<p><b>Action Plan</b></p>	<ul style="list-style-type: none"> <li>• identifies a likely threat to bald eagle population</li> <li>• finds and cites two sources that provide evidence of threat</li> <li>• identifies scientific vocabulary to use in action plan</li> </ul>	<ul style="list-style-type: none"> <li>• identifies actions that could minimize the identified threat</li> <li>• explains how research cited supports claim</li> <li>• uses appropriate scientific vocabulary to explain how proposed actions minimize threat</li> <li>• identifies audience</li> </ul>	<p>Develops an action plan to minimize the identified threat. This plan:</p> <ul style="list-style-type: none"> <li>• uses student’s model to illustrate source and effect of a likely threat</li> <li>• incorporates research findings to support claim about threat</li> <li>• purposefully addresses a specific individual or organization</li> <li>• precisely uses grade-level scientific vocabulary</li> </ul>	<p>All of Practitioner, plus discussion of additional species that are threatened <i>and</i> that benefit from this change in the ecosystem.</p>
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## What If...? Modeling Eagle Habitats *Scaffold for Learning*

<p><b>How-To Sheets</b></p> <ul style="list-style-type: none"> <li>▪ Observe and record data</li> <li>▪ Find relevant and authentic sources</li> <li>▪ Cite sources</li> </ul>	<p><b>Learning Centers</b></p> <ul style="list-style-type: none"> <li>▪ Flow of Energy</li> <li>▪ Habitats</li> <li>▪ Producers and Consumers</li> <li>▪ Cause and effect</li> </ul>	<p><b>How-To Videos/Podcasts</b></p> <ul style="list-style-type: none"> <li>▪ Create a flow chart</li> <li>▪ Create a model</li> <li>▪ Make a scientific argument</li> </ul>	<p><b>Homework</b></p> <ul style="list-style-type: none"> <li>▪ Nature walk and habitat observation</li> <li>▪ Define your own ecosystem</li> </ul>
<p><b>Benchmark Lessons</b></p> <ul style="list-style-type: none"> <li>▪ Habitat</li> <li>▪ Relationships in an Ecosystem</li> <li>▪ Wildlife Conservation</li> <li>▪ Human Impacts</li> <li>▪ Climate Change Connections</li> </ul>	<p><b>Small-Group Mini Lessons</b></p> <ul style="list-style-type: none"> <li>▪ Identify organisms</li> <li>▪ Components of an ecosystem</li> <li>▪ Flow of energy</li> <li>▪ Parts of a habitat</li> <li>▪ Cause and effect</li> </ul>	<p><b>Outdoor Exploration</b></p> <ul style="list-style-type: none"> <li>▪ Visit Duke Farms</li> <li>▪ Nature walk and habitat observation</li> <li>▪ Record observational data</li> <li>▪ Identify organisms</li> </ul>	<p><b>Individual Tasks</b></p> <ul style="list-style-type: none"> <li>▪ Observe and record data</li> <li>▪ Habitat awareness</li> <li>▪ Plant and animal classification</li> <li>▪ Ecosystem diagram</li> <li>▪ Interdependencies in an ecosystem</li> <li>▪ Flow of energy</li> <li>▪ Vocabulary</li> </ul>
<p><b>Group Tasks</b></p> <ul style="list-style-type: none"> <li>▪ Graphic Organizers for brainstorming</li> <li>▪ Research</li> <li>▪ Develop a plan/solution</li> <li>▪ Find an audience</li> </ul>	<p><b>Peer Tutoring</b></p> <ul style="list-style-type: none"> <li>▪ Technology</li> <li>▪ Relationships in an ecosystem</li> <li>▪ Peer review/feedback</li> </ul>	<p><b>Technology Uses</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Eagle Cam</a></li> <li>• Duke Farms <a href="#">eagle blog</a></li> <li>• <a href="#">Teacher's blog about the Duke Farms eagles</a></li> <li>• <a href="#">Bald comeback video</a></li> </ul>	<p><b>Interactive Websites</b></p> <ul style="list-style-type: none"> <li>▪ <a href="#">Brain Pop: Ecosystems</a></li> <li>▪ <a href="#">Ecosystem Game</a></li> </ul>

# What If...? Modeling Eagle Habitats Sample Content Facilitation Grid

<p>M – Mastered                      HW – Needs homework                      ML - SGML                      P – peer tutoring needed</p> <p><b>Student Name</b></p>	Identify eagle needs.	Explain difference between producers, consumers, and decomposers.	Explain how energy from the sun enters the ecosystem and supports all life.	Describe the place of the eagle in Duke Farms' ecosystem.	Describe the cycle of matter in the eagle's ecosystem.	Describe how the organisms in an ecosystem create a system of interdependencies.	Draw conclusions about effect of changing an aspect of the eagle's ecosystem.	Explain human impacts, positive and negative, on the eagle ecosystem.	Justify inclusion of various components in your ecosystem model.	Use model to predict how changing one element in the ecosystem will impact others.	Generate multiple ideas to protect the eagle's ecosystem from likely threats.

## What If...? Modeling Eagle Habitats *Sample Facilitation Questions*

<p><b>COMPREHENSION</b>  <i>Ask questions that ensure students understand content and skills needed to solve the problem.</i></p>	<p>What is a habitat?</p> <p>What is an ecosystem?</p> <p>How do animals get energy?</p> <p>Why is it important to collect data on a species' habitat?</p>
<p><b>APPLICATION</b>  <i>Ask questions that ensure the ability of students to apply learning to new situations.</i></p>	<p>How does a wildlife cam, like the Duke Farms' eagle cam, deepen our understanding of ecosystems?</p> <p>How does climate change affect an ecosystem?</p> <p>How does an ecosystem maintain balance?</p>
<p><b>CONNECTION</b>  <i>Ask questions that ensure the ability of students to apply learning to their lives.</i></p>	<p>How does wildlife conservation impact your life?</p> <p>How can you contribute to wildlife conservation?</p> <p>How does the health of a top predator population impact the health of populations throughout an ecosystem?</p>
<p><b>SYNTHESIS</b>  <i>Ask questions that encourage students to create new information from existing data.</i></p>	<p>How could you get others to understand the importance of wildlife preservation?</p> <p>What would happen if one of the organisms in the bald eagles' habit became extinct?</p> <p>What is the significance of objectivity and subjectivity in a scientific argument?</p>
<p><b>METACOGNITION</b>  <i>Ask questions which prompt students to think about their own thinking process.</i></p>	<p>What evidence or data did you gather that helped to make this worthwhile?</p> <p>What logistical issues did you face with modeling?</p> <p>How does scientific modeling apply to other phenomena you observe?</p>