SCIENCE·3D

HELLBENDERS: SAVING THE SNOT OTTER

SCIENCE PERFORMANCE EXPECTATIONS AND DISCIPLINARY CORE IDEAS

In the Elementary School Mission (NGSS Grade 4), students will address the general topics below. For a complete list of NGSS standards covered in each segment of the mission, continue reading after the general standards. *Note: Be sure to complete the **Mission Reader** and **Mission Research** before viewing the full **Mission Video**. Explore How to Use Science 3D to get suggestions on how to pace the mission and options for the order of activities. Math and Language Arts standards will be added shortly.*

- In the **Mission Reader**, *Hellbenders: Saving the Snot Otter*, students will learn about these incredible salamanders, life cycles, freshwater ecosystems, erosion and deposition, and human impacts on the environment. They will also learn about how people can reduce environmental impacts.
- During **Mission Research**, students compare and contrast life cycles and apply their understanding of habitats and human impacts to freshwater ecosystems. Consider assigning students a selection of the questions or activities provided to address the standards (science or language arts) that you want to emphasize.
- In the **Science Mission**, students will use what they learned from the **Mission Reader** and **Mission Video** to predict how changes in environments may help or harm animals. Then, they will use data to make graphs and determine which abiotic factors and human impacts affect hellbender populations. Finally, they will use their knowledge and scientific data to develop hypothesis about what has happened to rivers and suggest where hellbender populations might be restored.
- In the **STEM Project**, students will investigate the engineering design process and apply their understanding to design a possible engineering solution to help endangered Chinese giant salamanders survive.
- Using the **Explore Your Backyard** activity, students will reinforce their understanding about how changing environments may harm or help organisms and how traits influence how these organisms will respond to changes.

SCIENCE/ENGINEERING AND DESIGN DISCIPLINARY CORE IDEAS AND PERFORMANCE EXPECTATIONS

MISSION READER

4-L-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
4-ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation. This standard is discussed but should be supplemented by hands-on labs to measure and/or observe the process in action. In the reader, erosion by water is the only mechanism covered.
LS1.A	Structure and function.

Additional content: Behavior, erosion and deposition, freshwater habitats, human impacts on environment.

MISSION RESEARCH

4-LS-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
LS1.A	Structure and function.
PE 4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. Note: to cover this standard in depth, have students compare their drawings and discuss the costs and benefits of the solutions they developed to improve hellbender habitats. Have students think about and explain how they would measure the success of different designs.

Additional content: Life cycles.

SCIENCE MISSION

4-LS-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
LS1.A	Structure and function.

Additional content: Human impacts on environment, supporting arguments from evidence, abiotic factors.

*ELA and Math standards to come

GRADE 4

HELLBENDERS: SAVING THE SNOT OTTER
NGSS STANDARDS

STEM PROJECT

PE 4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. Note: to cover this standard in depth, have students compare their solutions for helping hellbenders reproduce. Have students think about and explain how they would measure the success of different designs.
3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
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.
ETS1.B	Developing possible solutions: communicating with peers about proposed solutions is important and can improve design.
ETS1.A	Defining and delimiting engineering problems.
ETS1. C	Optimizing the design solution.

EXPLORE YOUR BACKYARD

4-LS-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
LS1.A	Structure and function.

Additional content: effects of changes in environment on organisms.

CROSS CUTTING CONCEPTS

Cause and Effect: Mechanisms and Predictions: STEM Project, Mission Research, Explore Your Backyard
System and system models: STEM Project, Mission Reader, Mission Research
Structure and function: STEM Project, Mission Reader, Mission Research
Stability and change: Mission Reader, Mission Research, Explore Your Backyard

CONNECTION TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

Interdependence of Science, Engineering and Technology: Mission Reader, Mission Research. STEM Project shows role of science in creating engineering solutions and design.
Influence of Science, Engineering and Technology on Society and the Natural World: Mission Reader, Mission Research. STEM Project shows role of science and engineering on the natural world in respect to conservation and management.

CONNECTION TO NATURE OF SCIENCE

Scientific investigations use a variety of methods: Mission Reader, Science Mission
Scientific knowledge is based on empirical evidence: Mission Reader, Science Mission, STEM Project
Science is a way of knowing: Mission Reader, Science Mission
Science addresses questions about the natural and material world: Mission Reader, Science Mission
Science models, laws, mechanisms and theories explain natural phenomena: Science Mission

SCIENCE AND ENGINEERING PRACTICES

Asking questions and defining problems: Mission Reader, STEM Project
Developing and using models: STEM Project
Analyzing and interpreting data: Science Mission
Constructing explanations and designing solutions: Mission Reader, Science Mission, STEM Project
Engaging in argument from evidence: Mission Research, Science Mission, STEM Project
Obtaining, evaluating and communicating information: Mission Research, Science Mission, STEM Project, Explore Your Backyard
Planning and carrying out investigations: Science Mission
Using mathematics and computational thinking: Science Mission

*ELA and Math standards to come

GRADE 4

HELLBENDERS: SAVING THE SNOT OTTER
NGSS STANDARDS

CONNECTION TO NATURE OF SCIENCE

Scientific investigations use a variety of methods: Mission Reader, Science Mission, STEM Project
Scientific knowledge is based on empirical evidence: Mission Reader, Mission Research, Science Mission
Scientific knowledge is open to revision in light of new evidence: Science Mission. Although this is not covered explicitly, discussions of how interpretation of data changed between eDNA samples and in-river data in the **Science Mission** helps show how scientists update their understanding through time.
Science models, laws, mechanisms and theories explain natural phenomena: Mission Reader, Mission Research, Science Mission
Science is a way of knowing: Mission Reader, Science Mission, Explore Your Backyard
Scientific knowledge assumes an order and consistency in natural systems: Mission Reader, Science Mission
Science addresses questions about the natural and material world: All
Science is a human endeavor: Mission Reader, Science Mission, STEM Project

SCIENCE AND ENGINEERING PRACTICES

Asking questions and defining problems: Science Mission, STEM Project
Developing and using models: Mission Reader, Mission Research, Science Mission
Planning and carrying out investigations: Mission Research, Science Mission, STEM Project, Explore Your Backyard
Analyzing and interpreting data: Mission Research, Science Mission, STEM Project
Constructing explanations and designing solutions: Mission Research, Science Mission, STEM Project
Engaging in argument from evidence: Science Mission, STEM Project, Explore Your Backyard
Obtaining, evaluating and communicating information: All

*ELA and Math standards to come