SCIENCE·3D

# RIVER DRAGONS: NILE CROCODILES

## SCIENCE PERFORMANCE EXPECTATIONS AND DISCIPLINARY CORE IDEAS

In this Middle School Mission (NGSS Middle School), 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**, *River Dragons: Nile Crocodiles,* students will learn about change through time, continental drift, interactions of body systems, sensory systems and information processing, social behavior, life cycles, and human impacts on ecosystems. They will also learn about energy and force, the formation of deltas and how engineering and technology helps protect animals.
- During **Mission Research**, students will use their knowledge and the Mission Reader to explore how animal behaviors assist in reproduction and raising young successfully. Alternately, students can compare and contrast body systems of people and other types of vertebrates.
- In the **Science Mission**, students will explore changes in population sizes and how they influence genetic diversity. They will use mathematical models to estimate population sizes and determine how human activities and seasonal changes influence crocodiles. Throughout the lesson, they will develop hypotheses and predictions and test them using data that they graph and analyze. They will use their insights to determine where and when people, pets, and livestock will be most at risk from crocodiles.
- In the **STEM Project**, students focus on the use of models in science. They will explore and analyze diagrammatic models of plant and animal cells, and diagrammatic and mathematical models of ecosystems and energy flow. Then, they will create their own diagrammatic model (with a possible extension to create a physical model) of their own design that aims to keep both people and crocodiles safe.
- The **Explore Your Backyard** activity has students explore and then compare and contrast how different communities try to solve environmental challenges.

### SCIENCE/ENGINEERING AND DESIGN DISCIPLINARY CORE IDEAS AND PERFORMANCE EXPECTATIONS

#### MISSION READER

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| PS2.A | Forces and motion: motion determined by sum of forces and mass determines amount of force needed for similar change; must share units chosen to describe. |
| PS3.A | Definitions of energy: kinetic energy. |
| PS3.A | Definitions of energy: potential energy. |
| PS3.C | Relationship between energy and forces. Partial coverage of force. |
| MS-LS1.3 | Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. Focus is on interacting body systems more than on the cellular aspect with the exception of neurons. |
| LS1. A | Structure and function: body is a system of multiple interacting subsystems. |
| LS1.B | Growth and development of organisms: plant and animal reproduction and behavior. |
| MS-LS1-8 | Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. |
| LS1.D | Information processing. |
| LS2.A | Interdependent relationships in ecosystems: dependence on environment and may compete; resource limitation on organisms and populations. |
| MS-LS2-4 | Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. |
| ETS1.B | Developing possible solutions: process, criteria and constraints. |
| LS4.C | Adaptation. |
| ESS2.C | The roles of water in Earth's surface processes: weathering and erosion above and underground. Partial: formation of a delta. |
| ESS2.B | Plate tectonics and large-scale system interactions: supported by rocks and fossils. Covered in the Mission Reader briefly. Can be used as a link to more detailed geological mechanisms or the white shark activity that deals with the geological time scale and continental drift more explicitly. |
| ESS1.C | The history of planet Earth: tectonics. Covered in the reader briefly. Can be used as a link to more detailed geological mechanisms or the white shark activity that deals with the geological time scale and continental drift more explicitly. |

*ELA and Math standards to come

# MIDDLE SCHOOL

# RIVER DRAGONS: NILE CROCODILES NGSS STANDARDS

## MISSION RESEARCH

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| LS1. | A Structure and function: body is a system of multiple interacting subsystems. |
| MS-LS1-4 | Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants. |
| LS1.B | Growth and development of organisms: plant and animal reproduction and behavior. |
| LS4.C | Adaptation. |

## SCIENCE MISSION

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| LS1.B | Growth and development of organisms: plant and animal reproduction and behavior. |
| MS-LS2-1 | Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. |
| LS2.A | Interdependent relationships in ecosystems: dependence on environment and may compete; resource limitation on organisms and populations. |
| MS-LS2-4 | Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. |
| LS2.C | Ecosystem dynamics, functioning and resilience: change through time possible. |

Also covers: how genetic variation in a population is influenced by population sizes.

## STEM PROJECT

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| ETS1.B | Developing possible solutions: solutions need to be tested and modified |
| MS-LS1-2 | Develop and use a model to describe the function of a cell as a whole and ways that parts of cells contribute to function. Models of plant and animal cell are covered and students compare model to reality. Could be used to go into more depth on structure and function of cells. |
| LS1.A | Structure and function: within cells, special structures are responsible for particular functions. Models of plant and animal cell are covered and students compare model to reality. Could be used to go into more depth on structure and function of cells. |
| LS2.B | Cycles of matter and energy transfer in ecosystems: food web models. |
| ETS1.B | Developing possible solutions: process, criteria and constraints. |
| MS-ETS1-2 | Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. |
| ETS1.C | Optimizing the design solution: what works best under what conditions? |
| MS-ETS1-4 | Develop a model to generate data for iterative testing and modification of proposed object, tool, or process such that an optimal design can be achieved. |
| ETS1.C | Optimizing the design solution: iterative process leads to optimal solutions. |

## EXPLORE YOUR BACKYARD

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| MS-LS2-1 | Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. |
| LS2.A | Interdependent relationships in ecosystems: dependence on environment and may compete; resource limitation on organisms and populations. |
| MS-LS2-4 | Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. |
| LS2.C | Ecosystem dynamics, functioning and resilience: change through time possible. |
| MS-LS2-5 | Evaluate competing design solutions for maintaining biodiversity and ecosystem services. |
| ETS1.B | Developing possible solutions: process, criteria and constraints. |
| LS4.C | Adaptation. |

*ELA and Math standards to come

# MIDDLE SCHOOL

# RIVER DRAGONS: NILE CROCODILES NGSS STANDARDS

## CROSS CUTTING CONCEPTS

Patterns: Reader, Mission Research, STEM Project
Cause and effect: mechanisms and predictions: Reader, Science Mission, Explore Your Backyard
Scale, proportion and quantity: Reader, Science Mission, Explore Your Backyard
System and system models: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Energy and matter: Reader, Science Mission
Structure and function: Reader, Mission Research, Science Mission, STEM Project
Stability and change: Reader, Mission Research, Science Mission, Explore Your Backyard

## CONNECTION TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

Interdependence of science, engineering and technology: Reader, Science Mission, STEM Project, Explore Your Backyard
Influence of science, engineering and technology on society and the natural world: Reader, Science Mission, Explore Your Backyard

## CONNECTION TO NATURE OF SCIENCE

Scientific investigations use a variety of methods: Reader, Science Mission, STEM Project
Scientific knowledge is based on empirical evidence: Reader, Science Mission
Scientific knowledge is open to revision in light of new evidence: Reader, Science Mission
Science models, laws, mechanisms and theories explain natural phenomena: Reader, Mission Research, Science Mission, STEM Project
Science is a way of knowing: Reader, Mission Research, Science Mission, STEM Project
Scientific knowledge assumes an order and consistency in natural systems: Reader, Mission Research, Science Mission, STEM Project
Science is a human endeavor: Reader, Science Mission, STEM Project, Explore Your Backyard
Science addresses questions about the natural and material world: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard

## SCIENCE AND ENGINEERING PRACTICES

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

*ELA and Math standards to come