SCIENCE·3D

RAINFOREST BIODIVERSITY

SCIENCE PERFORMANCE EXPECTATIONS AND DISCIPLINARY CORE IDEAS

In the Middle School Mission, 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**, *Rainforest Biodiversity*, students will learn about biodiversity, ecosystem resilience, the causes of seasonal and daily cycles, global patterns of air circulation and precipitation, how water cycles through the "four spheres," and chemical processes in life (photosynthesis, cellular respiration, digestion). They will also explore light and sound waves in the rainforest, interactions among species, human threats to biodiversity, and how scientists study rainforests.
- During **Mission Research**, students will investigate the components of waves, how frequency and wavelength are related, and explore waves in their daily lives.
- In the **Science Mission**, students will explore how natural and human changes to the environment affect biodiversity. They will also explore how populations change in response to resources and biotic and abiotic changes in the environment. Students will develop hypotheses and predications that they test using data from the field. They will use data to create and interpret graphs.
- In the **STEM Project**, students will build a population model in a spreadsheet and explore how populations grow and are limited by factors in the environment.
- The **Explore Your Backyard** activity has students explore a local ecosystem to document the biodiversity in their area and to explore limiting resources for populations.

SCIENCE/ENGINEERING AND DESIGN DISCIPLINARY CORE IDEAS AND PERFORMANCE EXPECTATIONS

MISSION READER

MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures. The reader contains images of the structure of molecules involved in photosynthesis and respiration and could be used to reinforce these concepts more broadly.
PS1.A	Structure and properties of matter: substances made of different types of atoms; molecules range in size. The reader contains images of the structure of molecules involved in photosynthesis and respiration and could be used to reinforce these concepts more broadly.
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. The reader contains images of the structure of molecules involved in processes of photosynthesis and respiration and could be used to have students demonstrate that the number of atoms is conserved in these reactions.
PS1.B	Chemical reactions: substances react chemically in characteristic way from atom regrouping, mass does not change. The reader contains images of the structure of molecules involved in processes of photosynthesis and respiration and could be used to have students demonstrate that the number of atoms is conserved in these reactions.
PS1.B	Chemical reactions: some reactions release energy others store it. The reader discusses photosynthesis and respiration as examples.
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
PS4.A	Wave properties: characteristics.
PS4.A	Wave properties: sound must go through a medium.
PS4.B	Electromagnetic radiation: light.
PS4.C	Information technologies and Instrumentation.
MS-ESS2-4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
ESS2.C	The roles of water in Earth's surface processes: water cycle.
ESS2.C	The roles of water in Earth's surface processes: global movements because of sunlight and gravity.
ESS2.C	The roles of water in Earth's surface processes: how winds, landforms, ocean temp and currents affect movement of water in atmosphere and weather. Partial coverage in the context of the water cycle.

*ELA and Math standards to come

MIDDLE SCHOOL RAINFOREST BIODIVERSITY NGSS STANDARDS

MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. Covered with the exception of ocean circulation; integration of this standard is achieved in other missions.
MS-ESS1-1	Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses and seasons. This treatment shows the reason for seasonal changes and lunar phases but does not cover eclipses.
ESS1.B	Earth and the solar system: this model can explain eclipses, reasons for seasons (tilt) and differential sun intensity. This treatment shows the reason for seasonal changes and lunar phases but does not cover eclipses.
MS-LS-1-4	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.
MS-LS-1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
PS3.D	Energy in chemical processes and everyday life: photosynthesis.
PS3.D	Energy in chemical processes and everyday life: cellular respiration.
LS1.C	Organization for matter and energy flow in organisms: chemistry of photosynthesis.
LS1.C	Organization for matter and energy flow in organisms: food moves through chemical reactions in digestion.
MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth +/- release energy as this matter moves through an organism.
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.
LS2.A	Interdependent relationships in ecosystems: predation, mutualism, interactions similar across ecosystems.
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
LS2.B	Cycles of matter and energy transfer in ecosystems: food web models.
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.
LS2.C	Ecosystem dynamics, functioning and resilience: biodiversity definition and as measure of health.
LS4.D	Biodiversity and humans.
LS4.C	Adaptation.

MISSION RESEARCH

MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
PS4.A	Wave properties: characteristics.

SCIENCE MISSION

MS-LS-1-4	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.
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-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
LS2.B	Cycles of matter and energy transfer in ecosystems: food web models.
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.
LS2.C	Ecosystem dynamics, functioning and resilience: biodiversity definition and as measure of health.
LS4.D	Biodiversity and humans.
PS4.C	Information technologies and instrumentation.

*ELA and Math standards to come

MIDDLE SCHOOL RAINFOREST BIODIVERSITY NGSS STANDARDS

STEM PROJECT

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.

EXPLORE YOUR BACKYARD

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-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
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.
LS4.D	Biodiversity and humans.

CROSS CUTTING CONCEPTS

Patterns: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Cause & Effect/Mechanisms & Predictions: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Scale Proportion and Quantity: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
System and System Models: Reader, Science Mission, STEM Project, Explore Your Backyard
Energy and Matter (flows, cycles and conservation): Science Mission
Structure and Function: Reader, Science Mission, STEM Project, Explore Your Backyard
Stability and Change: Reader, Science Mission, STEM Project, Explore Your Backyard

CONNECTION TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

Interdependence of Science, Engineering and Technology: Reader, Science Mission, STEM Project
Influence of Science, Engineering and Technology on Society and the Natural World: Reader

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, STEM Project, Explore Your Backyard
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, Explore Your Backyard
Science is a way of knowing: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Scientific knowledge assumes an order and consistency in natural systems: Reader, Mission Research, 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 problems: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Developing and using models: Reader, Mission Research, Science Mission, STEM Project, Explore Your Backyard
Planning and carrying out investigations: Science Mission, Explore Your Backyard
Analyzing and interpreting data: Mission Research, Science Mission, STEM Project, Explore Your Backyard
Using mathematics and computational thinking: Mission Research, Science Mission, STEM Project, Explore Your Backyard
Constructing explanations and designing solutions: Mission Research, Science Mission, STEM Project, Explore Your Backyard
Engaging in argument from evidence: Mission Research, 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