



# Resilient Planet: Protecting Our Ecological Future

**Investigate the health of our environment and discover how to protect our planet's ecosystems as they visit some of Earth's most diverse ecosystems to uncover the mysteries of our planet. Includes connections to engineering design and math with STEM Professionals:**

*Dr. Russell Cuhel - Senior Researcher at the Great Lakes WATER Institute, University of Wisconsin, Milwaukee*

*Dr. Robert Ballard - National Geographic Explorer-In-Residence*

*Dr. Sylvia Earle - National Geographic Explorer-In-Residence, Former Chief Scientist of NOAA*

*Dr. Enric Sala - National Geographic Emerging Explorer and Fellow Scientific Researcher at the Center for Advanced Studies of the Spanish Research Council*

*Dr. Leila Hatch - Regional Marine Bioacoustic Coordinator at Stellwagen Bank National Marine Sanctuary*

- **Mission 1: Invaders - A Constant Ecological Battle**
- **Mission 2: Survivors - Securing A Niche**
- **Mission 3: Paradise Lost - A Fragile Recovery**
- **Mission 4: Paradise Found - Earth's Natural Treasures**
- **Mission 5: The Rescue - Protect the Biosphere**

## Cross-Curricular Connections

### Reading & Writing for Technical Subjects:

LST.1: Read and comprehend science and technical texts independently and proficiently and write effectively for a variety of discipline-specific tasks, purposes, and audiences

LST.2: Extract and construct meaning from science and technical texts using a variety of comprehension skills

LST.2.2: Determine the central ideas or conclusions of a text; provide an accurate, objective summary of the text.

LST.2.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

LST.3.1: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to texts and topics.

LST.4.1: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LST.7.1: Conduct short research assignments and tasks to answer a question (including a self-generated question), or test a hypothesis, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

**Literature Selections:** *My Side of the Mountain* by Jean Craighead George, *Grouper Moon* by Cynthia Shaw, *Adventures on Dolphin Island* by Ellen Prager, *Devil's Breath* Volcano by Richard Trout, *Hoot* by Carl Hiaassen

**Math:** Algebraic Problem Solving, Using Ratios, Creating and Analyzing Graphs (Bar, Pie, Best-Fit Line), Unit Conversions, Analyzing Data

**Social Studies:** History - Colonization, Geography, Physical Systems, Environment and Society, Hawaiian Culture

**Art:** Constructing Models, Making Clay Fish, Producing PSA Videos

## Grades 4-5 Science Content & Engineering Standards

- 4.LS.1** Observe, analyze, and interpret how offspring are very much, but not exactly, like their parents or one another. Describe how these differences in physical characteristics among individuals in a population may be advantageous for survival and reproduction. (Missions 1, 2)
- 4.LS.2** Use evidence to support the explanation that a change in the environment may result in a plant or animal surviving and reproducing, moving to a new location, or dying. (Missions 1, 2)
- 4.LS.3** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction in different ecosystems. (Mission 2)
- 5.LS.1** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (Mission 1, 2)
- 5.LS.2** Observe and classify common Indiana organisms as producers, consumers, decomposers, or predator and prey based on their relationships and interactions with other organisms in their ecosystem. (Missions 2, 3, 4)
- 5.LS.3** Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. (Missions 2, 4)

## Grades 6-8 Science Content & Engineering Standards

- 6.LS.1** Investigate and describe how homeostasis is maintained as living things seek out their basic needs of food, water, shelter, space, and air. (Missions 1, 2, 3, 4, 5)
- 6.LS.2** Describe the role of photosynthesis in the flow of energy in food chains, energy pyramids, and food webs. Create diagrams to show how the energy in animals' food used for bodily processes was once energy from the sun. (Mission 1)
- 6.LS.3** Describe specific relationships (predator/prey, consumer/producer, parasite/host) and symbiotic relationships between organisms. Construct an explanation that predicts why patterns of interactions develop between organisms in an ecosystem. (Missions 1, 2, 4)
- 6.LS.4** Investigate and use data to explain how changes in biotic and abiotic components in a given habitat can be beneficial or detrimental to native plants and animals. (Mission 1, 2, 3)
- 6.LS.5** Research invasive species and discuss their impact on ecosystems. (Mission 1, 4, 5)
- 8.LS.5** Explain how factors affecting natural selection (competition, genetic variations, environmental changes, and overproduction) increase or decrease a species' ability to survive and reproduce. (Mission 1, 2)
- 8.LS.8** Explore and predict the evolutionary relationships between species looking at the anatomical differences among modern organisms and fossil organisms. (Missions 2, 3)
- 8.LS.9** Examine traits of individuals within a species that may give them an advantage or disadvantage to survive and reproduce in a stable or changing environment. (Missions 1, 2, 3, 4)

## Grades 9-12 Science Content Standards

- ES 3.1:** Create flowcharts that show the exchange of carbon and oxygen between the lithosphere, hydrosphere, biosphere, and atmosphere, including carbon dioxide and methane. Explain how human activities such as farming and industry, temperature change in oceans, and natural processes such as volcanic eruptions can speed or slow the cycling from reservoirs within the solid earth and oceans into the atmosphere. (Missions 1, 2)
- ES 3.2:** Create diagrams and flowcharts that show the cycling of between the lithosphere, hydrosphere, biosphere, and atmosphere for nitrogen. Complete the same for phosphorus excluding the atmosphere. Explain how human activities can alter the amounts of both phosphorus and nitrogen between these layers. (Missions 4, 5)
- Env.1.1** Understand and explain that ecosystems have cyclic fluctuations, such as seasonal changes or changes in population, as a result of migration, birth, and mortality. (Missions 1, 2, 3, 4, 5)
- Env.1.2** Understand and explain that human beings are part of Earth's ecosystems and give examples of how human activities can, deliberately or inadvertently, alter ecosystems. (Missions 3, 5)
- Env.1.3** Recognize and describe the difference between systems in equilibrium and systems in disequilibrium. Describe how steady state is achieved through negative and positive feedback loops. (Missions 1, 2, 3, 4, 5)
- Env.1.4** Diagram the cycling of carbon, nitrogen, phosphorus, and water and describe the human impacts on each. (Mission 1)
- Env.1.5** Identify and measure biological, chemical, and physical (abiotic and biotic) factors within an ecosystem. (Mission 1)
- Env.1.6** Describe the difference between weather and climate. Locate, identify, and describe the major Earth biomes. Explain how biomes are determined by climate (temperature and precipitation patterns) that support specific kinds of plants. (Mission 1, 2)
- Env.2.3** Recognize and explain that the amount of life any environment can support is limited by the available energy, water, oxygen, nutrients and minerals, and by the ability of ecosystems to recycle organic materials from the remains of dead organisms. (Missions 1, 2, 3, 4, 5)
- Env.4.1** Explain environmental policies/organizations (Clean Water Act, Clean Air Act, Endangered Species Act, Species Survival Plan, Resource Conservation and Recovery Act, Department of Energy, and the World Health Organization) and identify their impact. (Missions 3, 5)
- Env.4.2** Understand that environmental policies/decisions have negative and positive impacts on people, societies, and the environment
- Env.5.1** Explain how variation within a species increases the chances of survival of the species under changing environmental conditions. (Missions 3, 5)
- Env.5.2** Explain how the great diversity of species increases the chance that at least some living organisms will survive in the event of major global changes. (Mission 2, 4)

**Env.5.5** Identify the indirect and direct threats to biodiversity (e.g. habitat loss and destruction, invasion by exotic species, commercial overfishing and hunting, pollution, climate change, and bioaccumulation and biomagnification of toxins) (Missions 2, 4)

**Env.6.4** Explain how the carrying capacity of an ecosystem may change as availability of resources changes. (Missions 1, 2, 3, 4, 5)

**Env.7.3** Compare and contrast the effects of environmental stressors (i.e. herbicides, pesticides) on plants and animals. Give examples of secondary effects on other environmental components. (Missions 2, 4)