6th - 8th GRADE WRITING LESSON

SCIENCE IN THE NATURAL WORLD

50 MINUTES

Google

SCIENCE IN THE NATURAL WORLD
WRITING WITH GOOGLE EARTH

GOOGLE EARTH USAGE OVERVIEW:	Teachers will use the Voyager Story, Science in the Natural World, to **demonstrate real world applications** of the use of technology in scientific research. Teachers can select 1-6 different examples of technology in science.
LESSON SUMMARY:	• Using the Voyager Story, Science in the Natural World, students will **explore** several examples of how scientists are using technology to study the natural world. • Students will **gather evidence** to better understand how technology has enhanced scientists ability to study the natural world. • Students will **respond to the writing prompt**: How has technology enabled scientists to study the natural world? Cite specific evidence from the Voyager Story, Science in the Natural World, to support your explanation.
LEARNING OBJECTIVES:	• Based on information gathered in the Voyager Story, Science in the Natural World, students will **form a hypothesis** about the relationship between technology and scientific study. • Students will **write an informative/explanatory essay** demonstrating the role that technology has played in scientific study. Students will include a minimum of three specific examples from the Voyager Story, Science in the Natural World.

SUGGESTED STANDARDS
GRADES 6th - 8th

6th GRADE:

CCSS.ELA-LITERACY.W.6.2- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

CCSS.ELA-LITERACY.RI.6.1- Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

CCSS.ELA-LITERACY.RI.6.7- Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

7th GRADE:

CCSS.ELA-LITERACY.W.7.2- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

CCSS.ELA-LITERACY.RI.7.1- Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

CCSS.ELA-LITERACY.RI.7.3- Analyze the interactions between individuals, events, and ideas in a text (e.g., how ideas influence individuals or events, or how individuals influence ideas or events).

8th GRADE:

CCSS.ELA-LITERACY.W.8.2- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

CCSS.ELA-LITERACY.RI.8.1- Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

CCSS.ELA-LITERACY.RI.8.3- Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories).

LESSON OUTLINE WITH ESTIMATED TIME ALLOTMENT:

Introduce- 1 minute
Explore- 10 minutes
Engage- 20 minutes
Extend- 25 minutes

MATERIALS NEEDED:

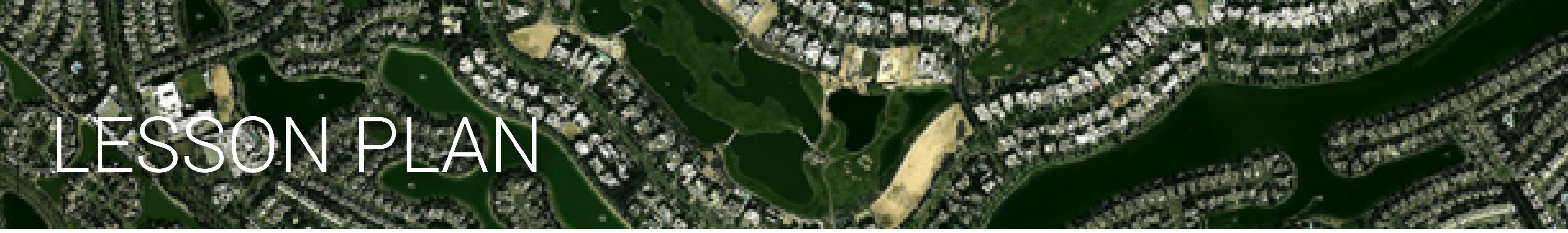
- Access to the Voyager Story, Science in the Natural World.
- Optional access to YouTube videos embedded in the Voyager Story, Science in the Natural World.
- Student copies of the Evidence Chart and Informative/ Explanatory Writing Template (below) OR teachers can share documents with students using Google Classroom.

VOCABULARY:

Coexist (verb) (reference here)
1. exist at the same time or in the same place.

Partition (verb) (reference here)
1. divide into parts.

Herbivore (verb) (reference here)
1. an animal that feeds on plants.



LESSON PLAN

INTRODUCE (1 minute)

Scientific research has always started with a question and sought to find an answer by forming and testing hypotheses. While this aspect of research remains the same, today we will explore how scientists are using new methods to gather data in search of their answers.

EXPLORE (10 minutes)

1. Introduce the Voyager Story, Science in the Natural World. Refer students to the text accompanying Slides 1-3. On Slide 2, use the coded map layers to highlight the GPS data collected for each species of antelope. (Option to show the YouTube videos if time permits, however it is not necessary for this lesson.)
2. Ask: What question were scientists trying to answer? What technology did they utilize to gather data? What information did they gain from the use of technology?
3. Chart student responses. (Scientists wanted to know how three related species of antelope could coexist in the same habitat. They used GPS collars and DNA metabarcoding. Scientists used technology to gain information about how each species uses their habitat and what specific types of plants each species eats).

ENGAGE (20 minutes)

1. Show between 2-5 more examples of the use of technology in scientific research from the Voyager Story, Science in the Natural World. Refer students to their copy of the text accompanying each slide. (Option to show the YouTube videos if time permits, however it is not necessary for this lesson.)
2. Prompt students to independently chart the answers to the following questions: What question were scientists trying to answer? What technology did they utilize to gather data? What information did they gain from the use of technology? How does this example of technology enable scientists to better study their subjects?

EXTEND (25 minutes)

1. Students will use their copy of the text from, Science in the Natural World, as well as their completed evidence chart to write an informative/explanatory essay in response to the following prompt:

How has technology enabled scientists to study the natural world? Cite specific evidence from the Voyager Story, Science in the Natural World, to support your explanation.

INFORMATIVE/EXPLANATORY RUBRIC

EXCEEDING:

- Creative and engaging introductory paragraph.
- Clearly stated main idea.
- 3 or more pieces of specific evidence to support main idea.
- Elaboration for all pieces of evidence clearly relates to the main idea.
- Information is organized in a purposeful, logical way.
- Strong connection between ideas.
- Use of a variety of transitional strategies.
- Use of domain specific vocabulary.
- Strong command of conventions.
- Effective conclusion for purpose and audience.

MEETING:

- Adequate introductory paragraph.
- Clearly stated main idea.
- 3 pieces of evidence supporting the main idea.
- Elaboration for 2 pieces of evidence clearly relates to the main idea.
- Information is loosely organized.
- Connection between some ideas, but not all.
- Adequate use of transitional strategies.
- Use of domain specific vocabulary.
- Adequate command of conventions.
- Adequate conclusion for purpose and audience.

APPROACHING:

- Weak introduction.
- Main idea is unfocused or not sustained throughout the essay.
- 2-3 pieces of evidence loosely supporting main idea.
- Elaboration does not relate to the main idea.
- Weak connection among ideas.
- Inconsistent use of transitional strategies.
- Unclear use of domain specific vocabulary.
- Partial command of conventions.
- Weak or lacking conclusion.

BEGINNING:

- Introduction is unfocused or absent.
- Main idea is confusing or ambiguous.
- Evidence is minimal, absent, or irrelevant.
- Elaboration is absent.
- Little or no organizational structure.
- No use of transitional strategies.
- No use of domain specific vocabulary.
- Lack of command of conventions.
- Absent or unfocused conclusion.

RESOURCES

ADDITIONAL RESOURCES:	• For more information on how elephants communicate, click here.
OPTIONS FOR DIFFERENTIATION:	• Utilize YouTube videos embedded in the Voyager Story, Science in the Natural World. • Allow students to create a slideshow, audio report, or video report in response to the writing prompt. • Provide students with an informative/explanatory writing graphic organizer (below). • Challenge: ask students to brainstorm a question or problem affecting the natural world and how they could use technology to solve it.
CREDITS:	Written by Sarah Schwartz Johnson in collaboration with Jason Wallis and Kevin Graham.

*Note - this template is designed for teachers to modify for use with their grade level and standards.

EVIDENCE CHART - SCIENCE IN THE NATURAL WORLD

Scientific Question	Technology Used	Information Gained	Elaboration

INFORMATIVE/EXPLANATORY WRITING TEMPLATE

Introduction & Main Idea
Evidence & Elaboration 1
Evidence & Elaboration 2
Evidence & Elaboration 3
Conclusion

TEXT, SCIENCE IN THE NATURAL WORLD

Slide 1- Studying Animal Diets with DNA Metabarcoding, Gorongosa National Park, Mozambique

One of the big questions in ecology is how do similar animals coexist in the same place. Dr. Robert Pringle and his team use cutting-edge technology to better understand the ways in which three different species of African antelope partition their habitat.

Slide 2- How Antelope Use Their Habitat

One way that animals may coexist is by partitioning their habitat. That means they might each use slightly different parts of the habitat. In Gorongosa, the team placed GPS collars on kudu, nyala and bushbuck, three related species of antelope. The collars report hourly locations for about 10 months, which can then be analyzed to see how each species uses its habitat. Ten individuals of each species were collared; here you can see a representative of each species.

Examine the data. What do you notice? The scientists noticed that each species preferred a slightly different part of the habitat, but they also had some overlap. If you zoom in, you can see the bushbuck data are clustered around clumps of vegetation. These are termite mounds. The kudu data, on the other hand, are distributed more evenly across the landscape, showing that they spend more time in the open. Nyala appear to prefer the wooded areas but roam a little more than bushbuck do. Since their use of habitat overlapped, scientists thought of other ways that the animals may share their habitat.

Slide 3- Discovering What Antelope Eat, Gorongosa National Park, Mozambique

Another explanation for how these animals share the same habitat might be that they eat different things. This is difficult data to get because it requires long hours in the field following specific individuals eating things that you may not be able to see.

Now, scientists have a new technology, called metabarcoding, to determine herbivore diets. They collect fresh dung samples, which contain DNA of plants the animal has recently eaten. The researchers extract the DNA sequences and compare them to a library of possible food sources to find a match. In this way, scientists can create a comprehensive picture of the diet of each animal. In Gorongosa, they found that kudu, nyala and bushbuck have distinct diets, which minimizes competition.

Slide 4, Radio Tracking Lizards, Puerto Rico

When Dr. Manuel Leal removed lizards from an area in the forest, he noticed an interesting phenomenon: all the lizards seemed to be back the next day. Watch as he sets up an experiment to study how these lizards navigate home.

Slide 5- Can Lizards Find Their Way Home? Puerto Rico

Dr. Leal and his team transported 15 anoles 80 meters from their respective home trees. Twelve of the 15 immediately headed in the right direction toward their home. Some never quite made it, but 5 made it all the way home within 24 hours. This is significantly better than you would expect based on wandering in random directions.

Slide 6- Ultrasonic Recordings of Bats and Moths, Gorongosa National Park, Mozambique

Bats are voracious predators of small insects like moths. Since they are nocturnal, they use sound to hunt; they produce high-frequency calls and listen to the echoes of their targets to find their position. Over time, moths have developed a number of strategies to avoid becoming a meal for a hungry bat.

Slide 7- Analyzing High Frequency Sound, Gorongosa National Park, Mozambique

Sound travels in waves and can be described in terms of the wave velocity, wavelength, and frequency. The frequency is the number of waves that pass a point per unit time measured in hertz (Hz), the number of waves per second. The range of human hearing is about 20 – 20,000 Hz.

Some animals, like bats, produce sounds that are above the human hearing range. The spectrogram linked below shows the low-frequency call of an insect (6,000 Hz on the y-axis) and the high-frequency call of a bat (70,000 Hz). Humans can hear the insect but not the bat, unless the sound is played 20 times more slowly.

Slide 8- Studying Bumble Bees with RFID Tags, Madison, Wisconsin

Are human activities affecting the bumble bees' ability to find enough food? Does resource availability affect bee behaviors, such as foraging time? To answer these questions, Jeremy Hemberger, a graduate student at the University of Wisconsin-Madison, designed a system for measuring the length of a bumble bee's foraging trips. He attaches radio frequency identification tags to several bumble bees in a colony to record individual bees' comings and goings in a variety of environmental conditions.

Slide 9- Bumble Bees as Pollinators, Agricultural fields across the world

Bumble bees are important pollinators of many valuable crops. They are generalists — meaning they pollinate a variety of crops — and, unlike honey bees, they are able to forage under a variety of weather conditions. This makes them well-suited as pollinators of crops in temperate environments.

Scientists have analyzed records dating back 110 years and determined that climate change is restricting bumble bees' range, thereby restricting their habitat. This, combined with habitat loss due to land use change and increased pesticide use, points to a challenging future for these important insects.

Slide 10- Shaking the Ground to Study Elephant Communication, Etosha National Park, Namibia

Dr. Caitlin O'Connell-Rodwell studies elephant communication in Etosha National Park in Namibia. She observed that elephants seem to detect vibrations in the ground using their feet and trunk. In this video we see the experiments that she devised to test her observations. To do this, she needed to set up a way to transmit low-frequency sounds through the ground and compare how elephants reacted versus how they reacted to call through the air.

Slide 11- Elephant Communication

Scientists who study animal communication spend long hours in the field observing wildlife. For a given species, the scientists develop a catalog of ways that the animals communicate. Elephants use many forms of physical and auditory cues. Below are four sounds — see if you can match the sound with the following catalog entries: social trumpet, aggressive snort, greeting grumble and nasal trumpet.

Slide 12- Building Cages to Study Ecology, Beaufort, North Carolina
Not all of the technology used to do science is high-tech. In this video, Dr. Brian Silliman uses very simple methods to discover that, contrary to previous theories, salt marshes are controlled by the feeding behavior of animals that live in the marsh. Using simple equipment that can be purchased from the local hardware store, Dr. Silliman built cages on the marsh to show that if snails are excluded, more grass survives. He then used plastic stakes, glue and fishing line to show that blue crabs keep snail populations in check. If crab populations are reduced, by overfishing for example, then snail populations can explode and cause widespread die-off of salt marshes.

Slide 13- The Importance of Salt Marshes, Chesapeake Bay, Virginia and Maryland
Salt Marshes
Salt marshes are lush intertidal grasslands. They occur all over the world in sheltered temperate coastal zones. Important ecological services they provide include defending shorelines against erosion, serving as critical nursery habitat for important fisheries and filtering pollution by dampening the harmful effects of agricultural runoff.

Scientists have mapped 5.5 million hectares of salt marshes distributed across 43 countries and territories. This map shows salt marsh occurrence along the east coast of the United States from North Carolina to New Jersey. Notice their prevalence in low-lying estuaries and coastal rivers.