6th GRADE LESSON PLAN *EXPLORING EARTH'S ECOSYSTEMS*

1 - 2 DAYS

Google

EXPLORING EARTH'S ECOSYSTEMS
6th Grade: 1 - 2 Day Inquiry Based Lesson Plan

GOOGLE EARTH USAGE OVERVIEW:	Teachers will use the Google Earth Voyager Story, Exploring Earth's Ecosystems, to provide multiple sources to consider for this **inquiry investigation.**
LESSON SUMMARY:	• Teachers will present students with the inquiry, *should humans intervene when imbalances in ecosystems are observed?* • Teachers will introduce 3 more sources of information using the Google Earth Voyager Story, Exploring Earth's Ecosystems. • Students will work to **identify and classify evidence** from each source in one of two categories: Yes (humans should intervene) or No (humans should not intervene). • After reviewing the evidence, students will **form a hypothesis** that they will share with the class. • With each new source of information, students will add to their evidence chart and make adjustments to their hypothesis. • Finally, students will **write an argument essay** using their final hypothesis as the claim and referring to specific evidence from the sources used.
INQUIRY:	• *Should humans intervene when imbalances in ecosystems are observed?*

EXPLORING EARTH'S ECOSYSTEMS (continued)

LEARNING OBJECTIVES:	• Students will **identify the point of view** being expressed in each source and the key details that support it. • Students will determine which side of the argument evidence supports. • Students will **form their own hypothesis based on evidence** found in each source. • Students will **participate in a discussion using accountable talk.** • Students will **revise their hypothesis** based evidence from new sources and class discussions. • Students will **write an argument essay** using specific evidence from all three sources to support their thinking.
CULMINATING TASK:	• Students will write an argument essay in response to the following prompt: *Should humans intervene when imbalances in ecosystems are observed?* Use specific evidence from all three sources to support your claim.

SUGGESTED STANDARDS
Lesson Outline

SUGGESTED STANDARDS:
GRADE RANGE - 6th GRADE

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.6.2- Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

CCSS.ELA-LITERACY.RI.6.6- Determine an author's point of view or purpose in a text and explain how it is conveyed in 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.

CCSS.ELA-LITERACY.W.6.1- Write arguments to support claims with clear reasons and relevant evidence.

MS-LS1-5 From Molecules to Organisms: Structures and Processes- Construct a scientific explanation tbased on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

LESSON OUTLINE WITH ESTIMATED TIME ALLOTMENT:

Total time: 1-2 days

Day 1:
Introduction- 5 minutes
Source 1
- Explore - 25 minutes
- Engage - 20 minutes
- Extend- 10 minutes

Source 2
- Explore - 25 minutes
- Engage - 20 minutes
- Extend- 10 minutes

Day 2:
Source 3
- Explore - 25 minutes
- Engage - 20 minutes
- Extend- 10 minutes

Culminating Task - 60 minutes

Lesson Outline (continued)

MATERIALS NEEDED:

- Access to the Google Earth Voyager Story, Exploring Earth's Ecosystems.
- Access to the Youtube Videos embedded in the Google Earth Voyager Story, Exploring Earth's Ecosystems.
- Student Copies of the Text from the Voyager Story, Exploring Earth's Ecosystems, Evidence Chart and Argument Essay Writing Template OR teachers can share documents with students using Google Classroom.

VOCABULARY:

intervene (verb) (reference here)

1. come between so as to prevent or alter a result or course of events.

ecosystem (noun) (reference here)

1. a biological community of interacting organisms and their physical environment.

cascade (noun) (reference here)

1. a succession of devices or stages in a process, each of which triggers or initiates the next.

keystone species (noun) (reference here)

1. a species on which other species in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically.

trophic cascade (noun) (reference here)

1. powerful indirect interactions that can control entire ecosystems, occurring when predators in a food web suppress the abundance or alter the behavior of their prey, thereby releasing the next lower trophic level from predation.

producer (noun) (reference here)

1. producers are in the first trophic level in a food chain. They serve as a food source for consumers or for higher trophic levels. Producers are responsible for the production of organic compounds from atmospheric or aquatic carbon dioxide. All life on earth is directly or indirectly reliant on producers, hence, they form the base of the food chain.

Lesson Outline (continued)

VOCABULARY: (continued)

primary consumer (noun) (reference here)

1. primary consumer definition, (in the food chain) an animal that feeds on plants; a herbivore.

secondary consumer (noun) (reference here)

1. secondary consumer definition, (in the food chain) a carnivore that feeds only on herbivores.

natural selection (noun) (reference here)

1. the process whereby organisms better adapted to their environment tend to survive and produce more offspring. The theory of its action was first fully expounded by Charles Darwin and is now believed to be the main process that brings about evolution.

survival of the fittest (noun) (reference here)

1. the continued existence of organisms that are best adapted to their environment, with the extinction of others, as a concept in the Darwinian theory of evolution.

extinction (noun) (reference here)

1. the state or process of a species, family, or larger group being or becoming extinct.

fossil record (noun) (reference here)

1. a term used by paleontologists (see paleontology) to refer to the total number of fossils that have been discovered, as well as to the information derived from them.

mass extinction (noun) (reference here)

1. the extinction of a large number of species within a relatively short period of geological time, thought to be due to factors such as a catastrophic global event or widespread environmental change that occurs too rapidly for most species to adapt.

LESSON PLAN

INTRODUCE (5 minutes)

1. Introduce the Voyager Story, Exploring Earth's Ecosystems: Impacts. Read the text aloud:

Disruptions to ecosystems (by natural or human causes) can result in stresses on habitats, which can impact the number of individuals that can survive in a population, altering species ranges and diversity. Similarly, changes to one species in a habitat can affect other species that it interacts with, and effects can cascade through indirect interactions with other species.

Today we are going to look at three different examples of "impacts" in an ecosystem and gather evidence to answer the question: *Should humans intervene when imbalances in ecosystems are observed?*

EXPLORE (25 minutes)

1. Present the first source, Slide 3 of the Voyager Story, Exploring Earth's Ecosystems: Trophic Cascades. Read the text and prompt students to follow along on the Student Copy of the Text from the Voyager Story, Exploring Earth's Ecosystems (below).

2. Click on the interactive at the bottom of the slide. Present the trophic pyramid from the coastal Pacific Ocean and read the Introduction describing each level: producer, primary consumer, secondary consumer.

3. Click (right) to the short video showing what happened when sea otters were hunted to near-extinction in the Northeast Pacific Ocean. Prompt students to record specific evidence that humans should intervene (YES) or should not intervene (NO) in the Evidence Chart (below).

4. Click "Key Concepts" (bottom) to review the different types of relationships between members of an ecosystem and the concept of trophic cascade.

5. In this first source, we saw an example of an imbalanced ecosystem when sea otters were hunted to near-extinction. Use evidence from this example to write your first hypothesis in response to the inquiry, *should humans intervene when imbalances in ecosystems are observed?* Encourage students to site specific details to support their answer.

LESSON PLAN (continued)

ENGAGE (20 minutes)

1. Organize students into small groups or partners to share their hypothesis and discuss similarities or differences.

2. Ask students to move to either sides of the classroom designated as “YES (should intervene)” or “NO (should not intervene).” Call on volunteers to share their evidence in support of their hypothesis. Encourage students to use accountable talk by agreeing or disagreeing with the ideas that a classmate shared and providing new evidence as to why.

3. Consider posing the following questions to foster student discussion:
    - What was the cause of the ecosystem imbalance?
    - What was the effect of the ecosystem imbalance?
    - What would happen if humans did intervene?
    - What would happen if humans did not intervene?

EXTEND (10 minutes)

1. Prompt students to make any final adjustments to their hypothesis following the discussion.

LESSON PLAN (continued)

Next, repeat the process with a second source of information.

EXPLORE (25 minutes)

1. If your class has not been introduced to the concept of natural selection, provide necessary background information found in this short Youtube Video, The Theory of Evolution (by Natural Selection) by Cornerstone Education.
2. Introduce the second source of information in this inquiry investigation, Slide 4 of the Voyager Story, Exploring Earth's Ecosystems: Predator Impacts. Read the text and prompt students to follow along on the Student Copy of the Text from the Voyager Story, Exploring Earth's Ecosystems (below).
3. Present the Youtube Video, Selection by Predation: Lizard Experiment Results. Prompt students to record specific evidence that humans should intervene (YES) or should not intervene (NO) in the Evidence Chart (below).

ENGAGE (20 minutes)

1. Place students back into the same small groups or partners to share their updated hypothesis and discuss similarities or differences.
2. Ask students to move to either sides of the classroom designated as "YES (should intervene)" or "NO (should not intervene)." Ask students who are now on a different side of the room than in round one to raise their hands. Call on volunteers to share their evidence in support of their hypothesis. Encourage students to use accountable talk by agreeing or disagreeing with the ideas that a classmate shared and providing new evidence as to why.
3. Consider posing the following questions to foster student discussion:
    - What was the cause of the ecosystem imbalance?
    - What was the effect of the ecosystem imbalance?
    - What would happen if humans did intervene?
    - What would happen if humans did not intervene?

EXTEND (10 minutes)

1. Prompt students to make any final adjustments to their hypothesis following the discussion.

Next, repeat the process with a third source of information.

LESSON PLAN (continued)

EXPLORE (25 minutes)

1. Introduce the third source of information in this inquiry investigation: Slide 2 of the Voyager Story, Exploring Earth's Ecosystems: Extinctions. Read the text and prompt students to follow along on the Student Copy of the Text from the Voyager Story, Exploring Earth's Ecosystems (below).

2. Present the Youtube Video, Anthony Barnosky and Kaitlin Maguire Measure Mammal Extinctions. Prompt students to record specific evidence that humans should intervene (YES) or should not intervene (NO) in the Evidence Chart (below).

3. (Option to use the hhmi BioInteractive materials that accompany the Youtube Video, Anthony Barnosky and Kaitlin Maguire Measure Mammal Extinctions. Student Worksheet and Educator Materials can be found here.)

4. In this third source, we examined normal rates of animal species extinction based on mammals that existed millions of years ago and compared them to the current rates of animal species extinction. Use evidence from this example to write your second hypothesis in response to the inquiry, *should humans intervene when imbalances in ecosystems are observed*? Encourage students to site specific details to support their answer.

ENGAGE (20 minutes)

1. Place students back into the same small groups or partners to share their updated hypothesis and discuss similarities or differences.

2. Ask students to move to either sides of the classroom designated as "YES (should intervene)" or "NO (should not intervene)." Ask students who are now on a different side of the room than in round two to raise their hands. Call on volunteers to share their evidence in support of their hypothesis. Encourage students to use accountable talk by agreeing or disagreeing with the ideas that a classmate shared and providing new evidence as to why.

3. Consider posing the following questions to foster student discussion:
    - What was the cause of the ecosystem imbalance?
    - What was the effect of the ecosystem imbalance?
    - What would happen if humans did intervene?
    - What would happen if humans did not intervene?

LESSON PLAN (continued)

EXTEND (10 minutes)	1. Prompt students to make any final adjustments to their hypothesis following the discussion.

(Option to repeat this process with additional sources of information, each time resulting in an updated hypothesis.)

CULINATING TASK (80 minutes)	1. Students will write an argument essay in response to the following prompt: *should humans intervene when imbalances in ecosystems are observed?* Use specific evidence from all three sources to support your claim.

ARGUMENT WRITING RUBRIC

EXCEEDING:

- Clearly stated claim.
- 3 to 5 pieces of evidence from Voyager Stories, videos and/or text.
- Evidence is relevant and demonstrates student understanding.
- Clear explanation for every piece of evidence.
- Use of a variety of transitional strategies.
- Use of domain specific vocabulary.
- Strong command of conventions.

MEETING:

- Clearly stated claim.
- 3 pieces of evidence from Voyager Stories, videos and/or text.
- Evidence is relevant and demonstrates student understanding.
- Explanation of evidence is unclear.
- Adequate use of transitional strategies.
- Use of domain specific vocabulary.
- Adequate command of conventions.

APPROACHING:

- Clearly stated claim.
- 1 to 2 pieces of evidence from Voyager Stories, videos and/or text.
- Evidence is irrelevant and/or does not demonstrate student understanding.
- Explanation of evidence is unclear.
- Inconsistent use of transitional strategies.
- Unclear use of domain specific vocabulary.
- Partial command of conventions.

BEGINNING:

- Claim is unclear or absent.
- 1 piece of evidence from Voyager Stories, videos and/or text.
- Evidence is irrelevant and/or does not demonstrate student understanding.
- Explanation of evidence is unclear.
- No use of transitional strategies.
- No use of domain specific vocabulary.
- Lack of command of conventions.

RESOURCES

ADDITIONAL RESOURCES:	• Check out these related Google Earth Voyager Stories: Helping People and Animals Coexist, Chasing a Global Coral Bleaching Event, and What's Missing? • For a more indepth look at keystone species and trophic cascades, show the video, Some Animals are More Equal Than Others: Keystone Species and Trophic Cascades. • Choose a Newsela.com text on the topic of natural selection. • hhmi Biointeractive Classroom Activity illustrating natural selection, Look Who's Coming for Dinner: Natural Selection by Predation. • hhmi Biointeractive materials to accompany the Slide 2 Youtube Video, Anthony Barnosky and Kaitlin Maguire Measure Mammal Extinctions can be found here.
OPTIONS FOR DIFFERENTIATION:	• Provide students with Accountable Talk Sentence Stems from educationcloset.com. • Use a text coding strategy for students to identify examples of evidence for human intervention (yes) or against it (no). • Provide students with the Argument Essay Writing Template (below). • Option for extension: students must acknowledge and refute the counter argument in the introduction or conclusion of their argument essay.
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.

Student Copy of the Text from the Voyager Story, Goodall, Gombe and Google

Slide 1- Introduction from Jane

I'm excited to take you on a geographic journey to Tanzania's Gombe National Park and introduce you to some of the chimpanzees I have observed over the years, including one of Gombe's newer residents, a charming little fellow aptly named Google.

I hope to give you an up-close-and-personal look at major milestones in my life and career while opening a window into the lives of Google and the other Gombe chimpanzees. I know that, once you learn more about Google and the plight of endangered chimpanzees like him, you'll want to join me in doing everything you can to protect and preserve this amazing species and its habitat, the tropical forests of Africa.

Slide 2- Jane's Youth

Growing up in Bournemouth, England, I was fascinated by all kinds of animals. When I was young, my favorite books were Dr. Dolittle and the Tarzan series. All I wanted to do was go to Africa, observe the incredible animals living there, and write stories about them. Everyone laughed at my dream because I was a poor girl of little means living in England during World War II. My family couldn't afford to buy a bicycle, let alone send me to college.

Slide 3- Jane's Peak

I was given the opportunity to travel to Kenya, where I met Dr. Louis Leakey who would become my mentor. Dr. Leakey was looking for someone to begin a study of chimpanzees to gain insight into human beings' evolutionary past. He thought I would be a good person for the job because of my patience and persistent desire to understand animals. He also thought I would yield a fresh perspective because I hadn't been to college yet, and my mind hadn't been cluttered by rigid academia.

Once I arrived in Gombe, armed only with my binoculars and a notebook, I would climb to Gombe's highest peak in search of the chimpanzees. At the beginning, the chimpanzees ran away from me in fear because they had never seen a 'white ape' before.

Slide 4- Chimp Discoveries

As the days dragged into months and I hadn't made any significant observations, my spirits sank. Then came the day I shall never forget. In the fall of 1960, I came across the chimpanzee I named David Greybeard near the Peak. As I watched, David began to strip leaves off twigs to fashion a tool for fishing termites from a nest, similar to what you see in the 360 photo on the map. Until then, scientists thought humans were the only species to make and use tools, but here was evidence to the contrary. When I sent word back to Dr. Leakey, he replied via telegram and wrote: "Now we must redefine 'tool,' redefine 'man,' or accept chimpanzees as humans." This would be one of my most important discoveries.

Slide 5- The G-Family

During my field research, I also documented strong family bonds among chimpanzees, particularly between mothers and children. In addition, I observed the chimpanzees demonstrating a wide range of emotions much like human love, joy and greed. One family of chimpanzees, the 'G Family'

exemplified these traits from generation to generation. Gremlin, a female born in 1970, is a matriarch in Gombe. These days she is the only living member of the early generation of the G Family. Gremlin is a very intelligent chimpanzee and is considered an excellent mother by many who have observed her over the years.

Gremlin has given birth to eight children. Of her surviving five children, they and their own children are a central part of life in Gombe. Gremlin's first daughter, Gaia, is Google's mother. Born in 2009, Google is a healthy active youngster now headed into his adolesence. Golden and Glitter, the only twin chimpanzees known to have survived in the wild, are Gaia's younger sisters. Gimli and Gizmo, two brothers, make up the rest of the family.

Slide 6- Google the Miracle

Like her mother Gremlin, Gaia has a strong maternal instinct. In 2006, Gaia gave birth to her first son, Godot. For some reason, which we do not fully understand, Gremlin took young Gaia's baby from her and tried to raise him on her own. Sadly, without his mother, Godot died before he turned one.

In 2008, Gaia again gave birth, this time to tiny twins. Despite Gaia's attempt to defend the infants, Gremlin returned to the group after a prolonged absence and took the newborns. Unlike when Gremlin took Godot, Gaia made a great fuss when her mother grabbed the twins. Despite Gremlin's care, the first infant died. Gaia was grief-stricken and carried the lifeless body around for some time. Eventually, the other infant passed away as well.

Finally, in June 2009, Gaia gave birth to a healthy baby boy named Google. Fortunately, this time Gaia kept Gremlin away from the infant, and she is raising the baby on her own. Today, Google is a healthy, active youngster and an integral member of the G Family.

In August of 2013, producer and director Denise Zmekhol and cinematographer Bob Poole captured this amazing footage of little Google who was 4 years old at the time.

Slide 7- Threats to Chimpanzees: Habitat Loss

Although habitat within Gombe remains well-protected, outside the park the trees and forests that were there when I first arrived in 1960 were quickly being cut down as human populations in the surrounding villages continued to grow and the people needed land to build their homes and grow their food. This destruction of habitat has had a devastating effect on chimpanzees inside and outside the park.

Slide 8- Community Centered Conservation

To address the rapid deterioration of forests, the Institute began working with the local communities around Gombe in 1994 through the Lake Tanganyika Catchment Reforestation and Education (TACARE) project. In 2000, we started to apply cutting-edge satellite imagery, Geographic Information Systems (GIS), mobile and cloud mapping technologies to design and implement land use plans with communities and local governments that work better for both people and chimpanzees.

Student Copy of the Text from the Voyager Story, Exploring Earth's Ecosystems

Slide 1- Ecosystem Impacts, Makah Bay, Washington, USA

Disruptions to ecosystems (by natural or human causes) can result in stresses on habitats, which can impact the number of individuals that can survive in a population, altering species ranges and diversity. Similarly, changes to one species in a habitat can affect other species that it interacts with, and effects can cascade through indirect interactions with other species.

Slide 3- Trophic Cascades, Shemya Island, Alaska, USA

Trophic cascades have been a major theme in the last 40 years of ecology. The term describes how predators can determine the community structure of an ecosystem through a combination of direct and indirect effects. The classic example is Dr. Robert Paine's studies in which he removed starfish from tidepools and then observed the how all the other species were affected. Colleagues soon extended the work to other species including kelp, sea otters and orca whales.

Slide 4- Predator Impacts, The Bahamas

Besides affecting the population sizes of other species, the presence or absence of predators can also affect the force of natural selection that guides evolution. In this video, scientists introduced predators to small islands in the Bahamas and then observed the physical traits of the prey population.

Slide 2- Extinctions, John Day Fossil Beds National Monument, Oregon, USA

Human activity is changing ecosystems in profound ways, including driving the extinction of many species. However, extinction is a normal part of the evolutionary process and almost every species that has ever existed has gone extinct. The question is whether the rate of extinction caused by humans is greater than the normal extinction rate.

To answer this question, the scientists in this video use the fossil record to figure out the normal rate of extinction. Only then can they tackle the question of whether the current rate of animal extinction is abnormal.

Students can use the following chart to record evidence found in the Voyager Story, Exploring Earth's Ecosystems: Impacts and class discussions to answer the question: *Should humans intervene when imbalances in ecosystems are observed?*

EVIDENCE CHART

Source	YES, humans should intervene.	NO, humans should not intervene.
Trophic Cascades		
Hypothesis:		
Predator Impacts		
Hypothesis		
Extinctions		
Hypothesis		

Argument Essay Writing Template

Introduction:

Claim:

Evidence:

How does this evidence support your claim? Explanation:

Evidence:

How does this evidence support your claim? Explanation:

Evidence:

How does this evidence support your claim? Explanation:

Conclusion: