

Unit 5

Ecosystem Dynamics:

How does changing an ecosystem
affect what lives there?

Student Work Pages





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How does changing an ecosystem affect what lives there?

Student Work Pages

Core Knowledge Science



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Ecosystem Dynamics:

How does changing an ecosystem affect what lives there?

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Name: _____

Date: _____

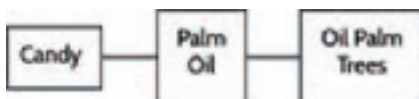
Develop an Initial Model: Candy and Orangutans

Discuss model components and interactions with your class. Then, record your agreed-upon components and ways to represent interactions in the space below.

Model components	Model interactions

Use *pictures, symbols, and words* in your model to help represent and explain the following:

How could buying candy that contains palm oil affect orangutan populations and other populations in the wild?



Name: _____

Date: _____

Asking Question Tool—Open/Closed Questions

1. What question are you working on?

2. What is the purpose of your question? Circle one of the reasons below or write in your reason.

Here are some reasons why people ask questions in science:

- *We don't understand how a phenomenon (or a part of the phenomenon) works*
- *We have a disagreement (in our model or with someone's explanation or argument)*
- *We need to test an idea we have*
- *Other reason: _____*

Closed-ended and Open-ended Questions: Questions that can be answered with "Yes" or "No" or with a single word are closed-ended questions. Asking open-ended questions gives you space to figure out more things. Scientific questions are open-ended questions.

3. Is your question closed-ended or open-ended? Circle one.

- Closed-ended (complete step #4)
- Open-ended (skip to step #5)

4. Revise your question to make it an open-ended question. Think about what you want to explain about the phenomenon. Try using:

- *How does...*
- *Why does...*
- *What happens when...*
- *What happens if...*
- *What is the difference between _____ and _____?*

Write your revised question:

5. What information or data do you need to answer your question?

6. How would this information or data help you achieve the purpose you circled in question #2?

Peer or Teacher Feedback

Name: _____

Provide feedback to another student using the following table.

Criteria	Yes or no?	Feedback and/or suggested revision
Is the question open-ended?		
Does the information or data in question #5 help answer the question?		
Does the question help the student achieve their purpose for asking the question?		

Name: _____

Date: _____

Farmer's Almanac: Oil Palm Plant

Growing Oil Palm

Nonliving growing conditions:

Oil palm is a tropical plant species. It grows best in places with a lot of sunshine, warm temperatures, and rainfall. It needs 2000 mm of rainfall each year (about 80 inches) and grows best in humid conditions (85%). The plant needs adequate sunlight—at least 6 hours of direct and constant light per day. It produces the most fruit when grown in areas that have an average temperature between 70 and 85°F (22 and 30°C).



Can we grow oil palm trees somewhere else so that we are not cutting down tropical rainforests?

Instructions: Have on hand your completed circled map, *Conditions to Grow Oil Palm Plants (C)*, *Conditions to Grow Oil Palm Plants (C2)*, and two colored pencils. Your task is to identify locations where oil palm grows but rainforests do not already exist.

- First, compare the locations that meet all three conditions on your *Conditions to Grow Oil Palm* data map to the *Location of Rainforests* data map.
- Next, locate places where there is overlap and where growing oil palms would require cutting down rainforests.
- Pick one color and color these regions on the blank map below.
- Next, locate places where if we grew oil palms, we would *not* have to cut down rainforests (e.g., where there is *no* overlap).
- Pick a different color and color these regions on this map.
- Add a key to your map to show what the two colors mean.



Name: _____

Date: _____

How have people changed the land where we live?

Instructions: Draw murals to show what the land where you live looked like a long time ago versus how it looks now.

- First, write in the blank in the top-left box to show when your “before” mural is set.
- On the left side of the T-chart, draw and label a mural to show what the land where you live looked like a long time ago.
- On the right side of the T-chart, draw and label a mural to show what the land where you live looks like now.
- Write a couple of sentences to answer the questions below your murals.

Part 1: Draw Murals of the Land Where You Live

What the land here looked like in: _____	What the land here looks like now: _____

Part 2: Describe Changes to the Land Where You Live Over Time

How did people change the land where you live?

Name: _____

Date: _____

Observations around Our School

Part 1: Noticings of Plant and Animal Life

Find a place to sit or stand comfortably. Look around you in all directions. Record what you notice about plant and animal life. You may see organisms directly or see signs that they were once present. After a few minutes, walk to a new location and make additional observations.

Plants: What plants are you noticing? Record your observations in words or sketches.	Animals, insects, and birds: What animal life are you noticing? Record your observations in words or sketches.

Part 2: Noticings of Change

Now make observations of ways that humans have changed the land around your school.

Changes How have humans changed the land around your school or neighborhood?

Part 3: Perspective Taking

Human perspective From a human’s perspective, do these changes help or harm any plants or animals?	Other perspectives Pick 1-2 organisms you observed or did not observe. From their perspective, did the change help or harm them?

Part 4: Wonderings

What wonderings do you have about changes to ecosystems in your own neighborhood? Post your wonderings to the DQB.

Name: _____

Date: _____

Palm Farm Designs

Part 1: Define the Problem

Read the problem summary below. Edit or add to it based on your class discussion of the problem.

Problem: Oil palm is a plant that provides a key ingredient for foods and cosmetics. Oil palm uses less land to grow compared to other crops, but it grows in the same places as tropical rainforests. Oil palm is a cash crop that provides farmers in Indonesia with a steady income to support their families. When farmers clear land to plant oil palm, they sometimes cut down tropical rainforests. This is related to decreases in orangutan and tiger populations.



Goal for a better oil palm farm:

Part 2: Define the Criteria and Constraints

Criteria: Standards that must be met by the design of the farm. (How will we know our designs work?)

- 1.
- 2.
- 3.

Constraints: Limitations to what can be designed. (What can we do or not do in our designs?)

- 1.
- 2.
- 3.

What do we need to test or measure to see if we meet the criteria and constraints?

Name: _____

Date: _____

Orangutan Populations in Protected Areas in Indonesia

Area of orangutan habitat	Year	Population size	Orangutans per km ² (100 hectares)
Leuser Ecosystem			
7,000 km ²	1993	12,040	1.72
	1998	4,710	0.67
	2004	7,501	1.07
	2008	6,600	0.94
Gunung Palung National Park			
1080 km ²	1995	2,800	2.59
	2001	2,500	2.31
	2004	2,500	2.31
	2020	2,500	2.31
Kutai National Park			
750 km ²	2004	730	0.97
	2008	500	0.67
Tabin Wildlife Reserve			
1,110 km ²	2004	1,285	1.16
	2008	1,401	1.26

Why Do Orangutans Need So Much Forest Space?

EXPERIMENT A: NORMAL FRUIT PRODUCTION

Before the Experiment

- My orangutan's name is: _____.
- Record the Independent Variable (% of fruit trees in the tropical rainforest): _____.
- **Make a prediction:** Do you think your orangutan will do about the same, better, or worse than the other orangutans? Why?

Run the Experiment

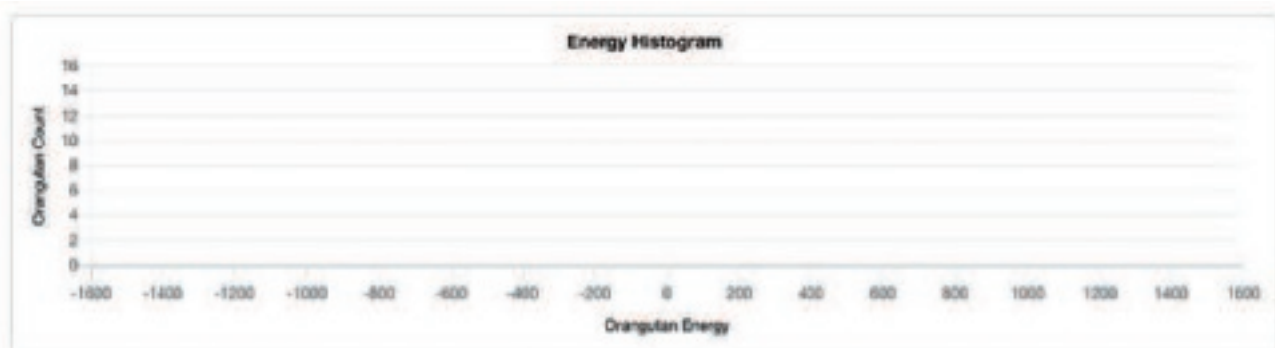
- **Observations.** Observe what makes it easier or harder for your orangutan to find food. Record notes and observations here.

- **Record the energy results.**

- Individual (one orangutan)—Ending energy for your orangutan: _____
- Population (all of the orangutans)—Minimum, maximum, and average energy:

minimum energy	maximum energy	average energy

Population (all of the orangutans): Histogram of energy for the population



1. **Make sense—Individual (ONE orangutan):** Make a claim about your orangutan and support it with evidence and reasoning.

Circle the claim you agree with.		
<u>My orangutan</u> was unsuccessful at finding food.	<u>My orangutan</u> was moderately successful at finding food.	<u>My orangutan</u> was very successful at finding food.
Data from the experiment that support my claim:		
Factors that contributed to the outcome for my orangutan:		

2. **Make sense—Population (ALL of the orangutans):** Make a claim about the orangutan population and support it with evidence and reasoning.

Circle the claim you agree with.		
The <u>orangutan population</u> was unsuccessful at finding food.	The <u>orangutan population</u> was moderately successful at finding food.	The <u>orangutan population</u> was very successful at finding food.
Data from the experiment that support my claim:		
Factors that contributed to the outcome for the orangutan population:		

EXPERIMENT B: FEWER FRUIT TREES

Before the Experiment

- My orangutan's name is: _____.
- Record the Independent Variable (% of fruit trees in the tropical rainforest): _____.
- **Make a prediction:** Do you think your orangutan will do about the same, better, or worse than the other orangutans? Why?

Run the Experiment

- **Observations.** Observe what makes it easier or harder for your orangutan to find food. Record notes and observations here.

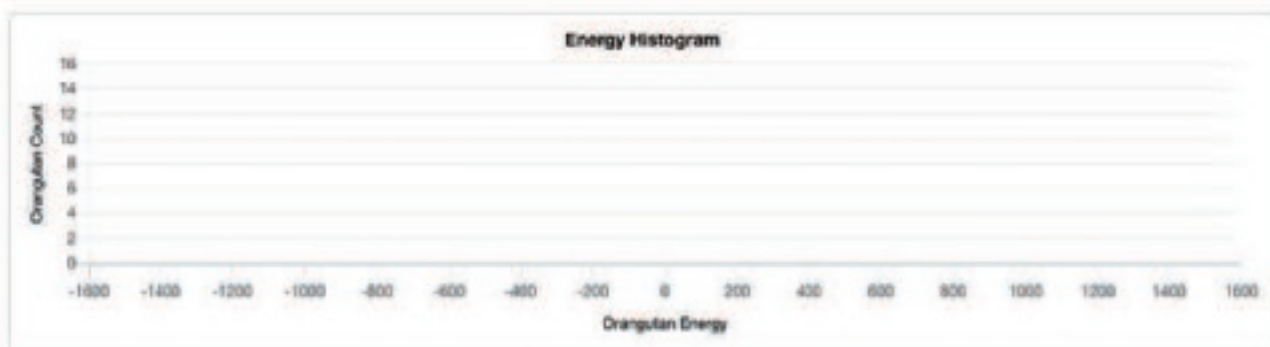
- **Record the energy results.**

- Individual (one orangutan)—Ending energy for your orangutan: _____
- Population (all of the orangutans)—Minimum, maximum, and average energy:

minimum energy	maximum energy

average energy

Population (all of the orangutans): Histogram of energy for the population



- 3. Make sense—Individual (ONE orangutan):** Make a claim about your orangutan and support it with evidence and reasoning.

Circle the claim you agree with.		
<u>My orangutan</u> was less successful at finding food compared to <i>Experiment A</i> .	<u>My orangutan</u> was equally as successful at finding food compared to <i>Experiment A</i> .	<u>My orangutan</u> was more successful at finding food compared to <i>Experiment A</i> .
Data from the experiment that support my claim:		
Factors that contributed to the outcome for my orangutan:		

- 4. Make sense—Population (ALL of the orangutans):** Make a claim about the orangutan population and support it with evidence and reasoning.

Circle the claim you agree with.		
The <u>orangutan population</u> was less successful at finding food compared to <i>Experiment A</i> .	The <u>orangutan population</u> was equally successful at finding food compared to <i>Experiment A</i> .	The <u>orangutan population</u> was more successful at finding food than in <i>Experiment A</i> .
Data from the experiment that support my claim:		
Factors that contributed to the outcome for the orangutan population:		

EXPERIMENT C: MORE FRUIT TREES

Before the Experiment

- My orangutan's name is: _____.
- Record the Independent Variable (% of fruit trees in the tropical rainforest): _____.
- **Make a prediction:** Do you think your orangutan will do about the same, better, or worse than the other orangutans? Why?

Run the Experiment

- **Observations.** Observe what makes it easier or harder for your orangutan to find food. Record notes and observations here.

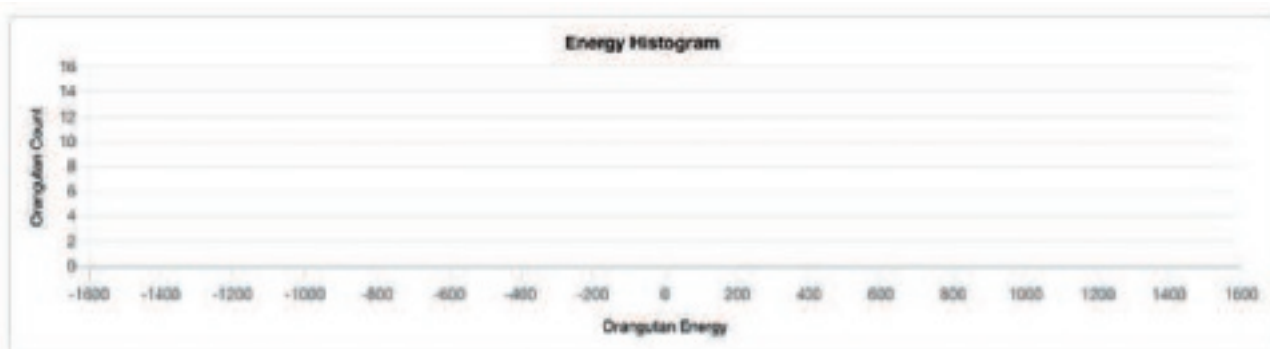
- **Record the energy results.**

- Individual (one orangutan)—Ending energy for your orangutan: _____
- Population (all of the orangutans)—Minimum, maximum, and average energy:

minimum energy	maximum energy

average energy

Population (all of the orangutans): Histogram of energy for the population



5. **Make sense—Individual (ONE orangutan):** Make a claim about your orangutan and support it with evidence and reasoning.

Circle the claim you agree with.		
<u>My orangutan</u> was less successful at finding food compared to <i>Experiment A</i> .	<u>My orangutan</u> was equally as successful at finding food compared to <i>Experiment A</i> .	<u>My orangutan</u> was more successful at finding food compared to <i>Experiment A</i> .
Data from the experiment that support my claim:		
Factors that contributed to the outcome for my orangutan:		

6. **Make sense—Population (ALL of the orangutans):** Make a claim about the orangutan population and support it with evidence and reasoning.

Circle the claim you agree with.		
The <u>orangutan population</u> was less successful at finding food compared to <i>Experiment A</i> .	The <u>orangutan population</u> was equally successful at finding food compared to <i>Experiment A</i> .	The <u>orangutan population</u> was more successful at finding food than in <i>Experiment A</i> .
Data from the experiment that support my claim:		
Factors that contributed to the outcome for the orangutan population:		

Name: _____

Date: _____

Would planting more rainforest fruit trees help the orangutan population increase?

EXPERIMENT 1: BIRTHS AND DEATHS WITH NORMAL FRUIT AVAILABILITY

Before the Experiment

1. Record the independent variable (% of fruit trees in the tropical rainforest): _____.
2. **Make a prediction:** How do you predict the size of the orangutan population will change over time? Sketch your predictions as a line graph on the chart below.



Run the Experiment

3. **Record the population results.** For each trial, record the population low, high, average, total number of births, and total number of deaths.

Trial	Low	High	Average	Births	Deaths
1					
2					

4. **Record the population size line graph.** Using a different color for each trial, sketch the orangutan population size versus time line graph. Label each trial color by placing a dot next to the trial in the chart above.



Make Sense

5. What claims can you make about the question “What will happen to the orangutan population if we add births and deaths to our simulation with normal fruit availability?”

6. Why did the population size fluctuate?

7. Why was it important that we conduct two trials?

EXPERIMENT 2: INCREASED RAINFOREST FRUIT TREES

Before the Experiment

8. **Determine an increased percentage of rainforest fruit trees.** Use a value above 25 percent to test the question “Would planting more fruit trees help the orangutan population increase?” Record the independent variable (% of fruit trees in the tropical rainforest): _____.
9. **Make a prediction:** How do you predict the size of the orangutan population will change over time with the increased percentage of fruit trees? Sketch your predictions as a line graph on the chart below.



Run the Experiment

10. **Record the population results.** For each trial, record the population low, high, average, total number of births, and total number of deaths.

Trial	Low	High	Average	Births	Deaths
1					
2					

11. **Record the population size line graph.** Using a different color for each trial, sketch the orangutan population size versus time line graph. Label each trial color by placing a dot next to the trial in the chart above.



Make Sense

12. Record your class data table in the space below:

% Rainforest Fruit Trees	Average Orangutan Population Size	Range of Orangutan Population Size

13. What claims can you make about the question “Would planting more fruit trees help the orangutan population increase?”

14. Why can you make this claim? What is your evidence?

15. What questions do you have now?

EXPERIMENT 3: SMALLEST PERCENTAGE OF FRUIT TREES TO SUPPORT AN ORANGUTAN POPULATION

Before the Experiment

16. Determine three different percentages of rainforest fruit trees to test. Record the three different values for the independent variable (% of fruit trees in the tropical rainforest):

Trial 1: _____ Trial 2: _____ Trial 3: _____

17. Make a prediction: How do you predict the size of the orangutan population will change over time with the increased percentage of fruit trees? Sketch your predictions as a line graph on the chart below. Use a different color for each trial. Label each trial color by placing a dot next to the trial in the chart above.



Run the Experiment

18. Record the population results. For each trial, record the population low, high, average, total number of births, and total number of deaths.

Trial	% Fruit Trees	Low	High	Average	Births	Deaths
1						
2						
3						

Make Sense

19. Record your class data table in the space below. If the entire orangutan population dies, indicate how many days it took for the orangutan population to die (e.g., 0 orangutans on day 440):

% Rainforest Fruit Trees	Average Orangutan Population Size	Range of Orangutan Population Size

20. What claims can you make about the question “What is the smallest percentage of rainforest fruit trees that could still support an orangutan population?”

21. Why can you make this claim? What is your evidence?

22. How might our findings help us design a solution to the oil palm problem?

Case Study Cards

Giant Panda Populations



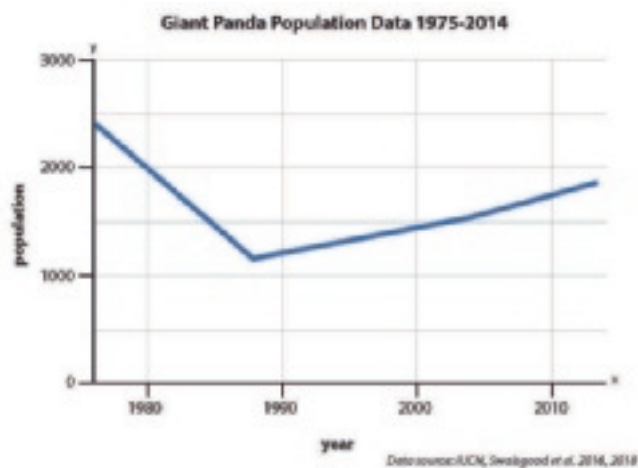
Giant pandas are easily identified by their thick black-and-white coat that keeps them warm in the cool temperate forests high in the mountains of south-central China.

Their diet is 99% bamboo, and they spend 10-16 hours a day eating! Giant pandas don't get a lot of energy from the bamboo, so they must eat large amounts of up to 20-40 pounds of bamboo a day. And, since they cannot digest much of the plant material, they also poop up to 40 times a day.

The biggest threat to giant panda populations is the loss of habitat to agriculture, livestock grazing, and bamboo and tree harvesting. Between 1974 and 1985, the panda habitat decreased by 50%.

Giant pandas rely on different species of bamboo, so that when one bamboo species flowers and dies, there are other bamboo species available.

Before habitat loss confined giant pandas to higher elevations, they could easily move up or down in the mountains to find different species of bamboo when needed. Now they are limited to a smaller area or are isolated, without a way to get to a new area for food.



Giant Panda Population Data 1975-2014 Giant pandas were once listed as rare but then shifted to endangered in 1990. This led to the 1988 Wildlife Protection Act and China's National Conservation Project. These measures banned poaching and established reserves for giant pandas, while also employing other methods to protect their habitat. Today there are 67 giant panda reserves, and their habitat range has increased.

In 2016, giant pandas shifted from being listed as *endangered* to *vulnerable*. Scientists say efforts to focus on regenerating bamboo forests and connect fragmented habitat through wildlife corridors are needed to keep the population growing and safe.

Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

Eastern Bobcat Populations

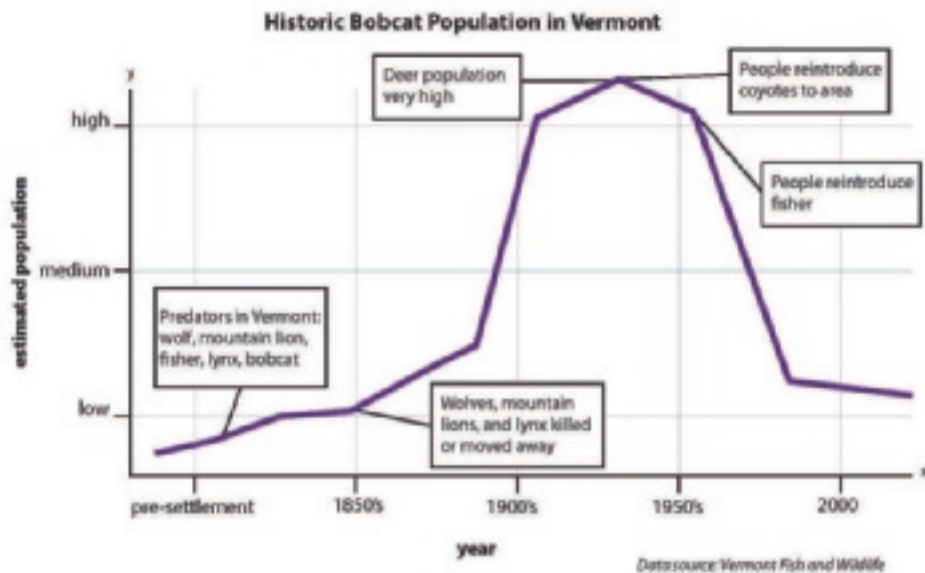


Eastern bobcats are common throughout New England, even though they are rarely seen. Bobcats are solitary and feed on various small animals, such as mice, chipmunks, squirrels, and birds, along with bigger prey like deer. Bobcats can be found in many different habitats, including coniferous forests, swamps, and partially forested mountain areas. Areas that have been recently logged and farms are good spots for bobcats because those habitats provide food and cover for the bobcat's prey.

When European colonists cleared more than 80% of Vermont's forests and allowed unchecked hunting, it resulted in the elimination of the wolf, mountain lion, and fisher. With few predators left to compete with, the bobcat filled the role as the area's top predator.

In the late 1800s, as farms slowly started to shift back to forestland, there was an increase of prey such as white-tailed deer and snowshoe hare.

White-tailed deer are an important food source for bobcats. Between 1930 and 1940, deer populations were at their highest levels. In the 1950s, coyote and fisher populations increased and started competing with bobcats for food.



Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

San Joaquin Kit Fox Populations

The San Joaquin kit fox is the smallest member of the dog family in North America. They have big pointy ears and weigh only 3-5 pounds.

Historically, they lived throughout California's San Joaquin valley in grasslands, scrublands, and wetlands. But they've lost habitat due to agricultural and urban development.

In 1967, the San Joaquin kit fox was listed as an endangered species.

San Joaquin kit foxes eat small rodents, including mice, kangaroo rats, black-tailed hares, desert cottontails, and some birds and insects. They also compete with coyotes, red and gray foxes, and bobcats for prey.

In addition to habitat loss, the San Joaquin kit fox is threatened by the increased use of pesticides and rodenticides. This has reduced the population of prey species like rabbits and hares, which are a favorite food source.

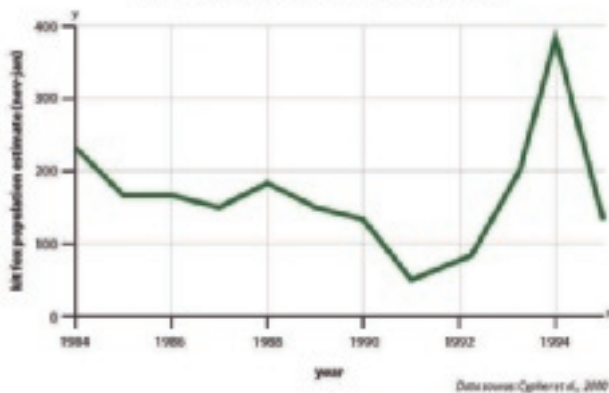
San Joaquin Kit Fox



Leporid (rabbits and hares)



Kit Fox Population at Naval Petroleum Reserves



Leporid Density Estimates



Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

Giraffe Populations in the Serengeti



Giraffes are the tallest mammals on Earth. They can be as tall as 19 feet, and their legs alone can be up to 6 feet tall!

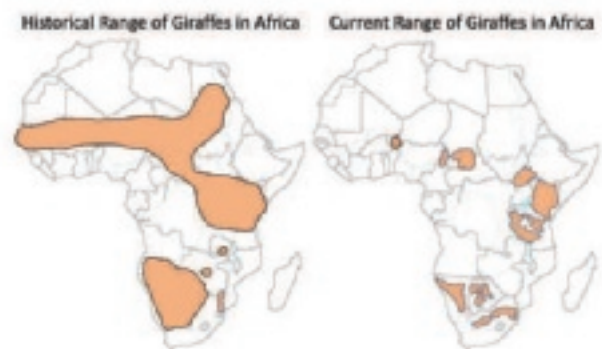
They are only found in sub-Saharan Africa, where they roam the savannahs eating tree leaves. They can often be found in groups of 12, feeding on acacia trees.

Their long legs and necks help them to reach their food, but their legs also make them easy targets for predators like lions, leopards, and hyenas: when they drink water, they must spread their legs wide to maintain stability. Doing this makes it really hard to start running if something comes up behind them.

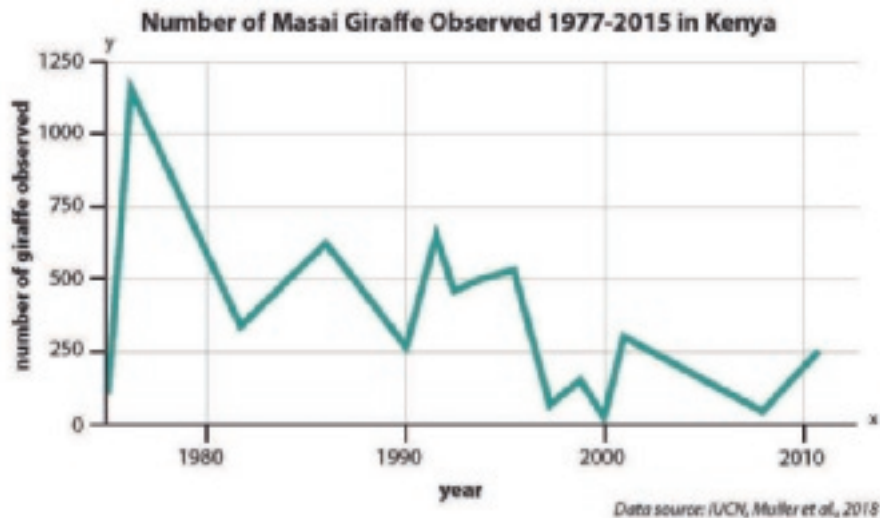
Between 1970 and 2000, sub-Saharan Africa has seen a lot of human population growth and urban development. This has led to a demand for increased food production, and the savannahs are being turned into agricultural fields for corn, soybeans, and livestock.

In the last several decades, the giraffe population has been declining. Within the last thirty years, the giraffe population has declined by nearly 30% across sub-Saharan Africa.

This map to the right shows where giraffes have historically lived (on the left) and where they currently live (on the right).



This graph below uses data collected in Kenya by scientists studying giraffe populations in the Athi-Kaupitiei ecosystem.



Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

Louisiana Black Bear Populations

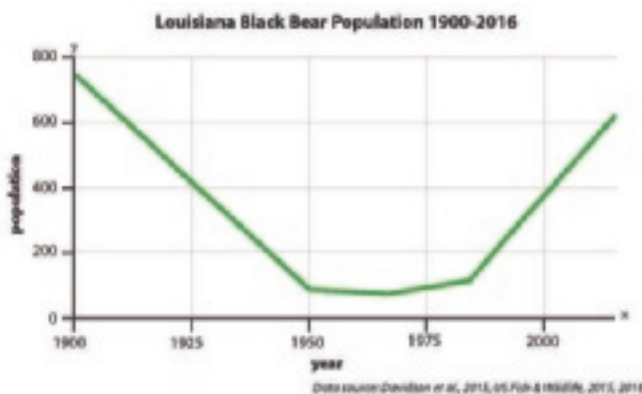


The Louisiana black bear is the state mammal of Louisiana. The Louisiana black bear is a subspecies, or type, of American black bear. It roams the hardwood forests of the Mississippi River valley.

In 1902, President Theodore Roosevelt went on a bear hunting trip to the Mississippi River valley. His hunting guide located and captured a Louisiana black bear. The guide chained the bear to a tree. He brought President Roosevelt to the bear so the president could shoot it, but President Roosevelt refused. He said it was unsportsmanlike. News of this event quickly spread across the country, and a toymaker started making “teddy bears” in honor of the president.

Louisiana black bears eat both plants and animals, but they also find a readily available food source in garbage thrown out by humans. These bears eat by season. In the spring and summer, they forage for berries, while in the autumn, they find acorns and other nuts to consume. These bears need large areas of forest for finding food and spots for dens.

The Louisiana black bear once roamed areas of Texas, Louisiana, and Mississippi. By 1980, more than 80% of the Louisiana black bear’s habitat had been modified or destroyed when forests were converted to farms. This changed their food supply and led to fragmented habitats that isolated the bears from other bears and food sources.



In 1992, the Louisiana black bear was listed as threatened on the Endangered Species Act list. Once listed, the bear and its remaining habitat were protected. Landowners and other groups worked to restore forest and wetland habitats.

The Louisiana black bear population has doubled since it was originally listed as threatened. The population is now considered to be healthy and in 2016 was no longer listed as endangered or threatened. Louisiana black bears thrive in large areas of forest not disturbed by humans or roads.

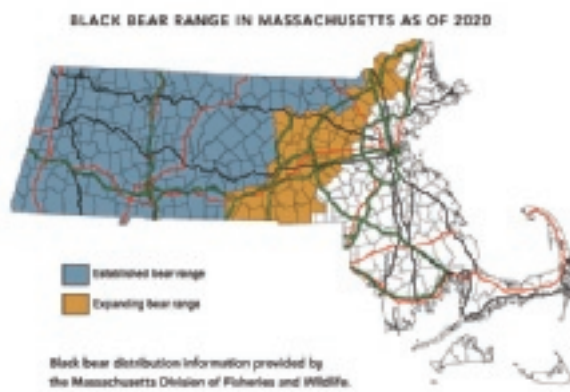
Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

Black Bear Populations



Black bears are found in forested areas throughout much of the United States. In Massachusetts, and in many parts of the United States, black bear numbers have been increasing. As their populations increase, they encounter humans and human development. However, black bears are not aggressive and will most likely run away if they see humans. A recent study in Massachusetts showed that black bears avoid humans by visiting developed areas at night, when human activity is low. Wildlife experts encourage people to take down their bird feeders and secure their garbage to discourage bear encounters.

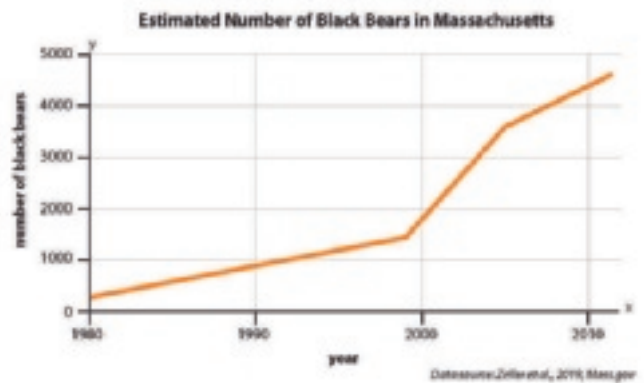


Massachusetts Division of Fisheries and Wildlife

Black bears typically feed on berries, fish, acorns, and even insects. They have an incredible sense of smell and can sense food from over a mile away! They will travel for food between 2 and 15 miles away. In areas where they live nearby humans, they will sometimes eat birdseed and garbage.

Although eastern Massachusetts is densely populated with humans, much of the western part of the state is forested or in the process of being rehabilitated from agricultural fields to forest. As the bears' range expands, they are getting closer to human development and take advantage of easy food sources like human food waste.

Black bear populations were once low, due to habitat loss and overhunting. However, their numbers have increased dramatically. In Massachusetts, there were an estimated 100 bears in the 1970s, compared to now where there are an estimated 4,500 bears in the state. You can even check out where black bears have been sighted in Massachusetts: <https://massbears.wordpress.amherst.edu/sightings-map/>.



Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

American Tree Sparrow

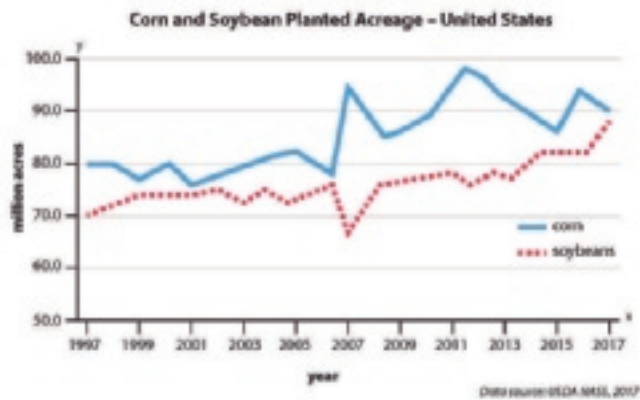


American tree sparrows are a type of songbird found throughout North America. They prefer to spend their time in grasslands, feeding on insects and weed and grass seeds. Tree sparrows also make their nests on the ground, using dried grasses and twigs, or nest near the ground in small shrubs.

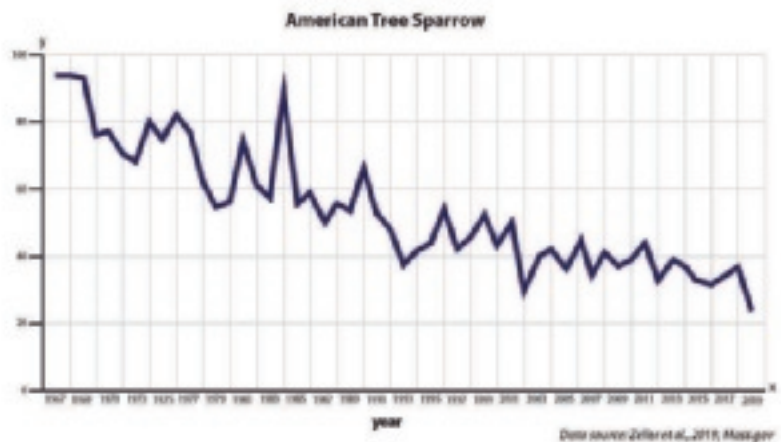
They spend the winter in the lower 48 United States, and in late spring, large groups of tree sparrows migrate to the tundra to spend the summer in the far north of the North American continent.

Since the 1990s, the tree sparrow population has been in a drastic decline in both the United States and Europe. In fact, the songbird population in general has been declining, with 75% of songbirds affected.

Over the last several decades, grassland habitat has been turned into vast agricultural fields for growing food for humans (corn, rice, and soybeans) and for cattle (hay). The graph to the right shows the change in corn and soybeans planted since 1997.



Each year, the National Audubon Society hosts an “Annual Christmas Count,” where community scientists gather to help keep track of the number of birds in particular areas throughout the United States. Scientists rely on data like these to help them understand which kinds of birds are still abundant and which kinds are declining. The graph to the right is based on data from the Annual Christmas Count and illustrates what scientists call “abundance,” which is a way to show how much of something still exists each year.



Directions:

- Identify the **trends** in the population:
 - Circle sections of the graph that show a decreasing population over time in **RED**.
 - Circle sections of the graph that show an increasing population over time in **BLUE**.
- Add words to describe what was happening to the resource during those times.

Name: _____

Date: _____

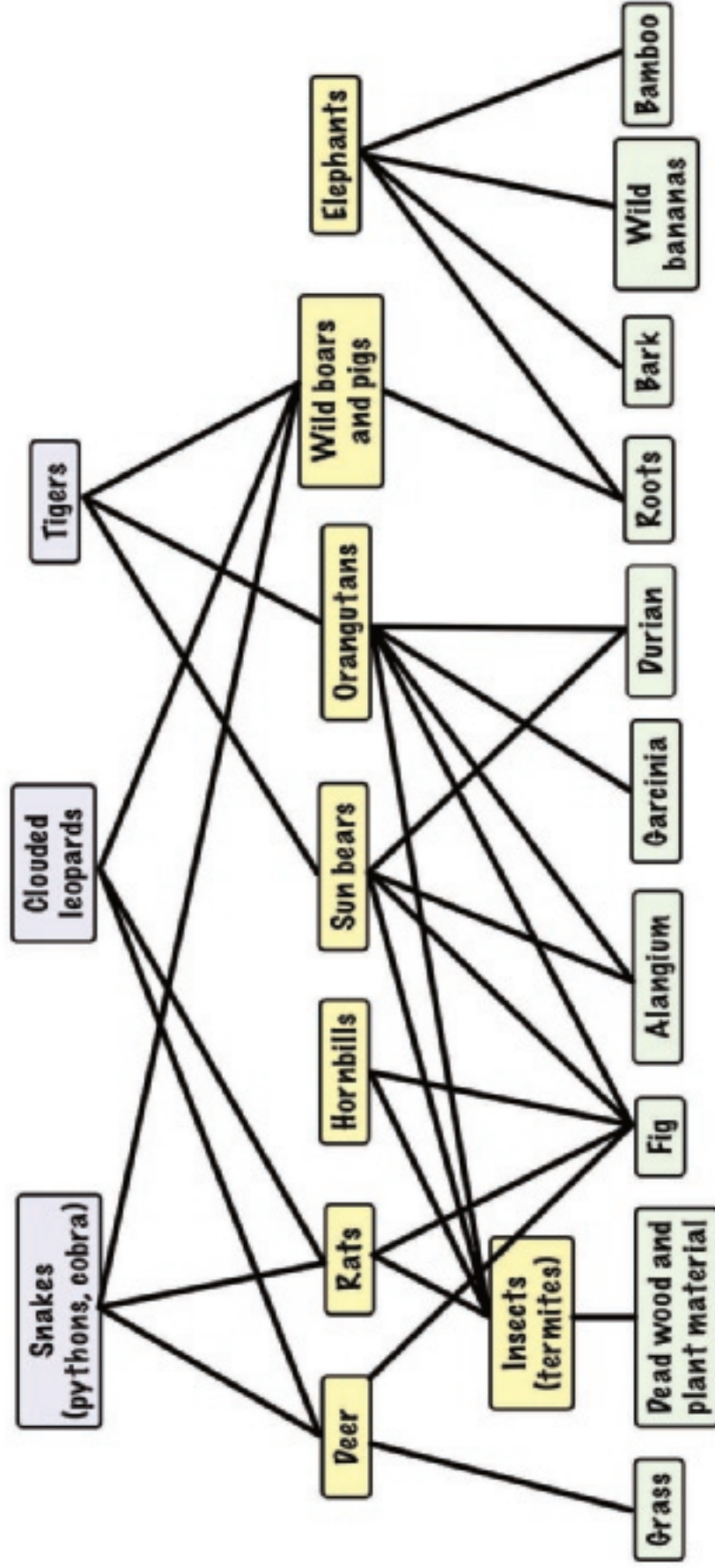
Self-Assessment for Classroom Discussions

1. Read each statement and mark YES or NO for whole-class discussions and/or small-group discussions.

Today, I...	In Whole-Class Discussions?		In Small-Group or Partner Discussions?	
	YES	NO	YES	NO
Shared my thinking by sharing new ideas, asking new questions, or asking for clarification from others.				
Listened actively to others by rephrasing, repeating, and/or reusing the ideas of others, and/or by asking others to repeat their statements or to clarify ideas when they are difficult to hear or understand.				
Respectfully gave critiques to others about their explanations, models, or questions by using observations, data, or evidence and asking questions.				
Invited others to share their thoughts.				

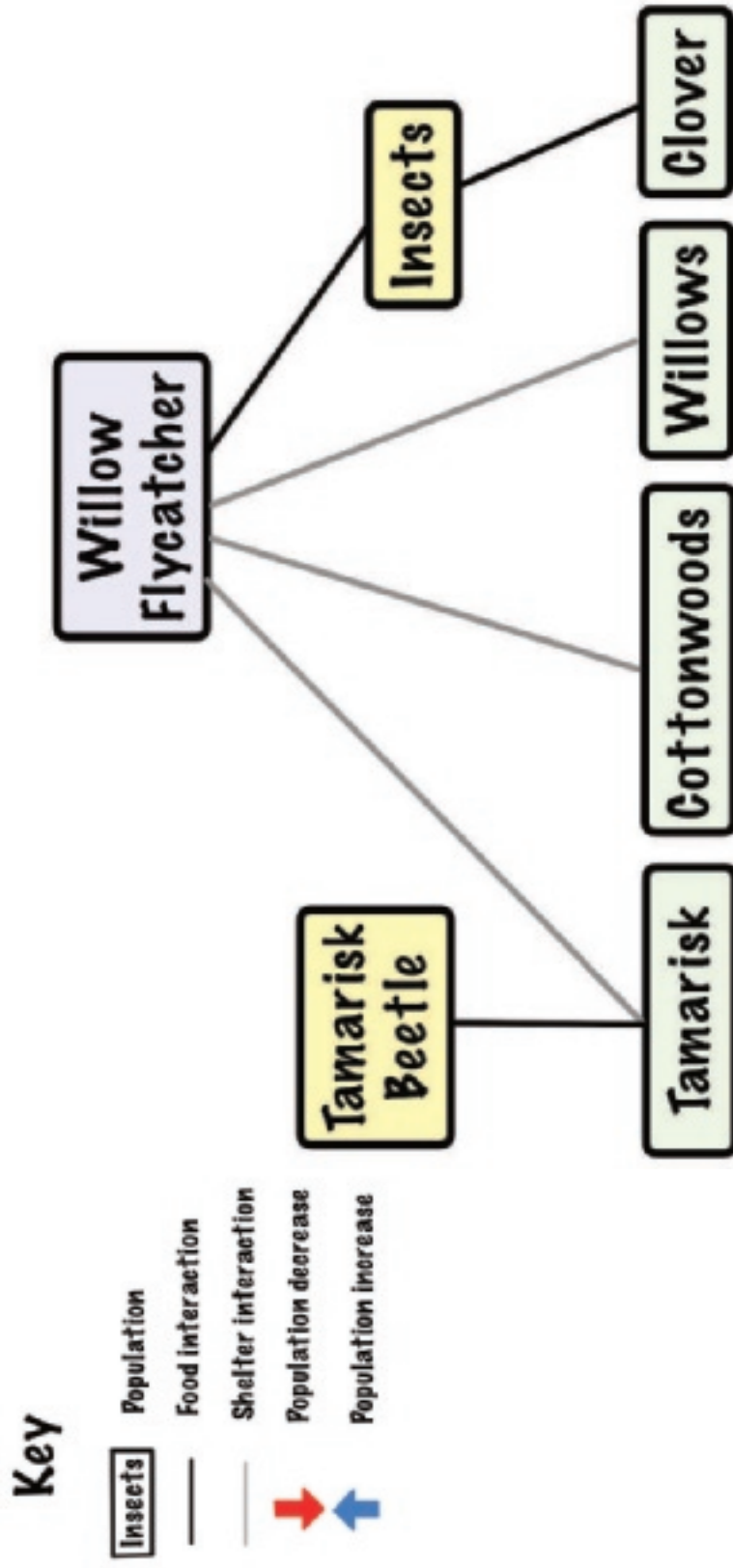
2. Choose one statement that you checked NO for or that you think you can improve on. Then write down 2 ideas for what you can do to improve in the next discussion.

Important food relationships



Southwestern Willow Flycatcher System Model

1. What would happen to the flycatcher population if the tamarisk beetle was introduced to an area with
 - mixed tamarisk, willows, and cottonwoods?
 - mixed tamarisk and willows, no cottonwoods?
 - mostly tamarisk, a few willows, no cottonwoods?
 - only tamarisk, no willows or cottonwoods?
2. Predict if the flycatcher population would increase, decrease, or stay the same, and discuss why.



Date: _____

Obtaining Information	
<p>Mark up the text using one of the following methods. For example:</p> <ul style="list-style-type: none">• Keep track of questions you have in the margins.• Circle key words.• Put question marks by words you want to learn more about.• Underline main ideas.	
What are the main ideas of the reading?	What are the supporting details?
<p>Read for the gist—skim the title, headings, and images.</p>	<p>Identify the ideas from the text that support the main ideas.</p>

Name: _____

Date: _____

Summarizing ways to grow food

Describe the way to grow food	How does this differ from industrial-scale monocrop farming?	How does this help populations in ecosystems?	Who is doing this?

Two-Column Notes

Obtaining Information	
View the StoryMap. Read the text and watch the videos. Jot down helpful ideas for answering our question: How can people benefit from growing food in ways that support plants and animals in the natural ecosystem?	
What are the main ideas of the StoryMap?	What questions do I have?
<i>What benefits are you seeing to farmers?</i>	<i>What things are confusing to you? What would you like more information about?</i>

Name: _____

Date: _____

Best Approaches to Growing Food for Animals, Plants, and People

Approach to Growing Food	Animals and Plants	People
Diversified farming and intercropping		
Sustainable oil palm and prairie strips		
Customary forests		
Monocropped farms		

Name: _____

Date: _____

Padu Banjar

Navigate to Padu Banjar, Indonesia, using Google Earth

Navigate to Padu Banjar, Indonesia, using Google Earth or another mapping software: <https://tinyurl.com/padubanmar>.

Make observations of Padu Banjar by zooming in on important features. On the image below, label the following features:

☐ Village 1

☐ Village 2

☐ Large-scale oil palm farm

☐ Small-scale oil palm farm

☐ Other crops

☐ River

☐ Protected tropical rainforest

☐ Customary forest

☐ Degraded land



Compare the Computer Simulation Layout to Padu Banjar, Indonesia

View the computer simulation layout at <https://www.openscienced.org/general/collaborative/>. The layout design is based on Padu Banjar. Try to identify the same important features that you identified in the satellite image of Padu Banjar. On the image below, label the following features:

☐ Village 1

☐ Large-scale oil palm farm

☐ Other crops

☐ Protected tropical rainforest

☐ Village 2

☐ Small-scale oil palm farm

☐ River

☐ Customary forest

☐ Degraded land (already cut down)



Name: _____

How can we redesign the way land is used in Indonesia to support orangutans and people at the same time?

Part A: Revise or Add to Our Definition of the Problem

Read the problem summary below. Edit or add to it, based on the progress you have made since we last defined the problem.

Problem: Oil palm is a plant that provides a key ingredient for foods and cosmetics. Oil palm uses less land to grow compared to other crops, but it grows in the same places as tropical rainforests. Oil palm is a cash crop that provides farmers in Indonesia with a steady income to support their families. When farmers clear land to plant oil palm, they sometimes cut down tropical rainforests. This is related to decreases in orangutan and tiger populations.



1. Revise or add to our goal for a better oil palm farm:

Part B: Revise or Add to Our Criteria and Constraints

2. Revise or add to our criteria and constraints:

Criteria:	Constraints:
Standards that must be met by the design of the land. (How will we know our designs work?)	Limitations to what can be designed. (What can we do or not do in our designs?)

Part C: Gather Baseline Data




3. What is the MAXIMUM average number of orangutans that could live in this area?

Use the “Forest Only” button to override the default and turn the entire layout into a tropical rainforest with 25 percent rainforest fruit trees.

Average number of orangutans:

4. What is the MAXIMUM income people can earn in this area? (Shade in the number of bills that represent maximum income for each area.)

Use the “Income Only” button to override the default and turn the entire layout, except for protected rainforest areas, into oil palm.

Area 1: 	Area 2: 	Area 3: 
--	---	--

5. How many orangutans and how much income does the default layout support?

Use the “Default layout” button to test the layout.

Average number of orangutans:		
Area 1: 	Area 2: 	Area 3: 

Part D: Plan Ways to Redesign Your Area of the Land

6. What is your assigned area and role? (Please circle one.)

Area 1:
Large-scale oil palm company

Area 2:
Small-scale oil palm farmer

Area 3:
Village elder

7. Plan ways to redesign your area of the land. As you plan, revisit the Goal from Part A and the Criteria and Constraints from Part B.

Below is the default design. Think about what you want to change about this design.



Use the space on the next page to sketch or describe a redesign plan for your area.

Redesign plan:

Features of your redesign	Explain why you think the features of your proposed redesign will support people, orangutans, or both

Part E: Test the Redesign

With your group, navigate to the Collaborative Oil Palm Model computer simulation:

<https://www.openscienced.org/general/collaborative/>

Work together with your group to redesign the land and run some tests. You may redesign and test as many times as you would like in order to optimize your design. Remember that your goals are as follows:

- Design a better way to use the land (see Part A: Revise or Add to Our Goal).
 - Support the largest orangutan population possible (see Part 3: Gather Baseline Data, "Forest Only").
 - Support adequate income for the people (see Part 3: Gather Baseline Data, "Income Only").
- Meet the Criteria and Constraints (see Part B: Revise or Add to Our Criteria and Constraints).

Note: The simulation will save your optimization and trial history. If at any point you would like to save your current work to return to it later, you may save the "Current Work Code" in the "Saving and Loading Your Work" section. You can load saved work by pasting the code into the "Load Saved Work" box and pressing "Recreating Experiment."



Reflect on the Redesign

8. Review your experiment and trial history. What were some key adjustments you made in your redesign? How did the adjustments help the orangutans, people, or both?

Part F: Evaluate Draft Solutions

Evaluate the redesigns from at least two other groups.

Group 1

9. What were the key features of the redesigns you viewed? How did the features support people, orangutans, or both?

Features of your redesign	Explain why you think the features support people, orangutans, or both

10. What is working well about the redesign?

11. What could the group change about the design, and why would this change better support orangutans or the people? *(In addition to recording your response in the space below, be sure to record a group response to this question on a sticky note to provide feedback to the group.)*

Group 2

12. What were the key features of the redesigns you viewed? How did the features support people, orangutans, or both?

Features of your redesign	Explain why you think the features support people, orangutans, or both

13. What is working well about the redesign?

14. What could the group change about the design, and why would this change better support the orangutans or people? *(In addition to recording your response in the space below, be sure to record a group response to this question on a sticky note to provide feedback to the group.)*

Part G: Optimize Redesign Solutions

Review the feedback you received from other groups.

15. Record your key takeaways below.

Optimize your redesign based on the feedback you received.

16. Review your experiment and trial history. What were some key adjustments you made to optimize your design?
How did the adjustments help the orangutans, people, or both?

Part H: Explain How Your Design Works for People and Orangutans

Construct an explanation about how your farm meets the goal for the design task.

- Identify 2 features of your design that worked (met the criteria).
- Explain why each feature supports people, orangutans, or both.









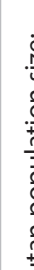








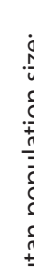








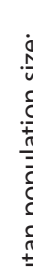









Features of your group’s farm that work	Explain why the feature works to support people, orangutans, or both












































































Construct an explanation about how your group farm meets the goals for the design task. Explain *how or why* combining the features above benefitted both people and orangutans at the same time. Remember to use the science ideas our class figured out in your explanation. You can also use data from the simulation in your explanation.

Name: _____

Date: _____

Solutions to Redesign the Land: Evaluations

Group	Criteria results	How well did the design meet the criteria and constraints?	What design features do I like? What are the trade-offs?	What wonderings do I have about the design?
	Orangutan population size: _____ Area 1    Area 2    Area 3   			
	Orangutan population size: _____ Area 1    Area 2    Area 3   			
	Orangutan population size: _____ Area 1    Area 2    Area 3   			
	Orangutan population size: _____ Area 1    Area 2    Area 3   			

Group	Criteria results	How well did the design meet the criteria and constraints?	What design features do I like? What are the trade-offs?	What wonderings do I have about the design?
	Orangutan population size: _____ Area 1      Area 2      Area 3     			
	Orangutan population size: _____ Area 1      Area 2      Area 3     			
	Orangutan population size: _____ Area 1      Area 2      Area 3     			
	Orangutan population size: _____ Area 1      Area 2      Area 3     			
	Orangutan population size: _____ Area 1      Area 2      Area 3     			

Name: _____

Date: _____

Argument for the Best Redesign of Land

1. Make a claim to answer the question, ***If you could make one recommendation to redesign the land in Indonesia to support people and orangutans, what would you recommend and why?***

My recommendation would be:

- 2. Write a convincing argument to support your claim.**

Your argument should include:

- Evidence from the simulation, including orangutan population size and income for the designs using this feature. You may want to include orangutan population size and income for the other designs and the baseline data comparisons. Include evidence from other investigations, too.
- Scientific reasoning that draws upon the science ideas we have figured out.
- Trade-offs that are important to know about.

[illegible]

3. What additional information could you add or change to respond to your peer's feedback?

Name: _____

Date: _____

PSA Communication Plan

Developing Your Communication Plan

Use the tables below to plan your communication strategy for your public service announcement (PSA).

Considerations	What your group is planning for your PSA
What audience are you targeting with your PSA?	
What actions are you suggesting to your audience? What are some challenges your audience might have with taking action?	
How are you going to convince people in your audience who might be skeptical or unwilling to take action?	
What media and strategies (visual, audio, etc.) will you use to present this information?	
How will you present your information so that it's informative, engaging, and convincing?	

Name: _____

Date: _____

Self-Assessment: Giving and Receiving Feedback

Self-Assessment: Giving Feedback

How well did you give feedback today?

Today, I . . .	Yes	No
Gave feedback that was specific and about science ideas .		
Shared a suggestion to help improve my peers' work.		
Used evidence from investigations, observations, activities, or readings to support the feedback or suggestions I gave.		

One thing I can do better the next time I give feedback is:

Self-Assessment: Receiving Feedback

How well did you receive feedback today?

Today, I . . .	Yes	No
Read the feedback I received carefully.		
Asked follow-up questions to better understand the feedback I received.		
Said or wrote why I agreed or disagreed with the feedback.		
Revised my work based on the feedback.		

What is one piece of feedback you received?

What did you add or change to address this feedback?

Obtaining Information Tools

Obtaining Information	
<p>Mark up the text using one of the following methods. For example:</p> <ul style="list-style-type: none">• Keep track of questions you have in the margins.• Circle key words.• Put question marks by words you want to learn more about.• Underline main ideas.	
What are the main ideas of the reading?	What are the supporting details?
<p>Read for the gist—skim the title, headings, and images.</p>	<p>Identify the ideas from the text that support the main ideas.</p>

What we are trying to figure out: _____

Obtaining Information Checklist	
<ul style="list-style-type: none">• Read for the gist—skim the title, headings, and images.	What are central ideas or claims being made?
<ul style="list-style-type: none">• Mark the text.	Select methods for marking the text. For example: <ul style="list-style-type: none">• Keep track of questions you have in the margins.• Circle key words.• Put question marks by words you want to learn more about.• Underline main ideas.
<ul style="list-style-type: none">• Examine any images, graphs, or tables.	Write one sentence about the central point of each image, graph, or table.
Evaluating Information Checklist	
<ul style="list-style-type: none">• Identify the claims in the text.	Were the ideas or claims shared supported by evidence? How so or how not?

Write your conclusion about the question we are trying to figure out here.

Analyzing and Interpreting Data Tools

ANALYZING DATA AND USING MATHEMATICS AND COMPUTATIONAL THINKING

Scientists collect data from investigations to understand what is going on and to construct arguments from evidence gathered from those investigations. Data by itself does not have meaning; scientists need to organize, analyze, and interpret their data to be able to communicate results to other scientists and the public.

What do you need to do when organizing, analyzing, or interpreting data? Use the table below to help you decide which tools you will need.

Purpose	What checklists do I use?
I need to show patterns or relationships in my data. . .	Organizing Data
I need to decide how to visualize or represent my data. . .	Organizing Data
I need to describe patterns or relationships in my data. . .	Analyzing Data
I need to use mathematics to make sense of my data. . .	Analyzing Data
I need to compare and/or synthesize across large data sets. . .	Organizing Data + Analyzing Data
I need to use digital tools to identify relationships in my data. . .	Organizing Data + Analyzing Data
I need to understand what my data means for the investigation/ phenomenon. . .	Interpreting Data
I want to decide if I can use data to make a claim or as evidence. . .	Interpreting Data
I need to describe why my data are important. . .	Interpreting Data
I need to communicate my data and findings to my peers. . .	Organizing Data + Analyzing Data + Interpreting Data

Once you decide what tool you need, use the tools below when you are looking at data and using mathematics and computational thinking. Each tool has a checklist of things to do *every time* you are doing the practice and things to do *when appropriate*. As you do the practice, check the box and respond to any questions in the right-hand column to help keep track of your work.

ORGANIZING DATA

Organize your data	
<ul style="list-style-type: none"> Determine the purpose of using these data. 	<p>Why are you using these data? What is the purpose of these data for your investigation/ phenomenon?</p>
<ul style="list-style-type: none"> Select a way to display the data that will be most useful to you. 	<p>Select the data display method(s) that will be most useful to you. (Check all that you will use.)</p> <ul style="list-style-type: none"> Data table Graph Map Other visual representation: _____ Mathematics, including: _____ <p>Describe why the methods you selected above will help you connect the data to your purpose for using the data:</p> <p>If you are using secondhand data, is the data represented in a way that will be most useful to you or do you need to reorganize it for your specific purpose?</p>
May also need to . . .	
<ul style="list-style-type: none"> Create your data table. 	<p>What data should be included in the table? What can be left out?</p> <p>What are your table headings?</p> <p>What units will you use for your data values?</p>
<ul style="list-style-type: none"> Construct a graph or chart from your data. 	<p>What do the axes of your graph/chart represent?</p> <p>How does this graph/chart help you see patterns or relationships in your data?</p>

<ul style="list-style-type: none"> Decide if the organization of your data is helping you. 	<p>Is there a different way to organize, visualize, or represent your data that would help you see patterns more clearly?</p>
<ul style="list-style-type: none"> Decide how you will compare multiple data sets. 	<p>What are the similar characteristics of your data sets?</p> <p>What do you need to do to them (for example, creating graphs, creating tables, comparing mapped data, using mathematics) to be able to compare or synthesize them?</p> <p>Why is comparing or synthesizing multiple data sets important? How could this help you answer your question?</p>

ANALYZING DATA

Analyze your data	
<ul style="list-style-type: none"> Identify patterns in your data. 	<p>What patterns do you see in the data?</p> <p>If you have a data table, what patterns do you see when you:</p> <ul style="list-style-type: none"> Look down the columns Look across the rows <p>If you have a graph, what patterns do you see when you:</p> <ul style="list-style-type: none"> Look left to right Look up and down Zoom out and look at the entire graph <p>If you have mapped data, what patterns do you see when you look at:</p> <ul style="list-style-type: none"> Different locations or places Different landforms or geographic features (mountains, rivers, oceans, etc.) Spatial scale (zoomed into one location or zoomed out to a larger location) Time scale (a short amount of time compared to a longer amount of time)
<ul style="list-style-type: none"> Identify relationships in your data. 	<p>What relationship are you trying to understand? Complete this sentence: "I am trying to understand the relationship between _____ (A) and _____ (B)."</p> <p>What pattern do you see between _____ (A) and _____ (B)?</p>
<ul style="list-style-type: none"> Use statistics to analyze your data. 	<p>What mathematics are best suited to give you insights into your data? (Check all that you will use.)</p> <ul style="list-style-type: none"> Mean Median Mode Variability Rate Ratio Other: _____ <p>How will using the mathematics you chose help you make sense of your data?</p>

INTERPRETING DATA

Interpret your data

- Connect back to the purpose of using your data.

What were you using your data for?

What patterns did you expect to see in your data (expected)? What patterns did you see in your data (unexpected)? What does this tell you?

- Determine what the data mean in the context of your chosen investigation or phenomenon.

What do the patterns or relationships you uncovered mean for your investigation or the phenomenon?

May also need to...

- Determine what the patterns in your data mean.

For every pattern you identify, what does that pattern in your data mean? Complete the following for each pattern:

What I see:

What it means:

- Decide if you can make a claim using your data as evidence.

What claim, if any, can you make that your data support?

Describe how your data support your claim.

<ul style="list-style-type: none"> Determine if your data show causal or correlational relationships. 	<p>What relationship are you investigating? Complete this sentence: "I am investigating the relationship between _____ (A) and _____ (B)."</p> <p>Can the study design (where the data came from) provide evidence as to whether A causes B? Explain why or why not.</p> <p>If yes, what evidence do you have to support the claim that A causes B?</p> <p>If no, what can you conclude right now?</p> <p>What additional evidence is needed to make a causal claim?</p>
<ul style="list-style-type: none"> Decide how you will communicate about your data. 	<p>How will you communicate the patterns and relationships in your data to your peers?</p>

Mapping the _____ to the _____

This part of the _____ ...	is like this part of _____ ...	because...	and is not like it because...

Name: _____

Date: _____

Self-Assessment: Giving and Receiving Feedback

Self-Assessment: Giving Feedback

How well did you give feedback today?

Today, I . .	Yes	No
Gave feedback that was specific and about science ideas .		
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Revised my work based on the feedback.		

What is one piece of feedback you received?

What did you add or change to address this feedback?

Name: _____

Date: _____

Science Literacy Exercise Page 1

Use with Reading Collection 1

Roadmap for Reading

This week's reading collection focuses on the effect that the extraction of living and nonliving resources for human use has on ecosystems.

Collection 1: "Using Earth" consists of four selections.

- 1 Extracted Resources
- 2 Shopping for Oils
- 3 Once Hunted for Oil, Now an Ecotourism Draw
- 4 Land Cover Changes in the U.S.

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Create a chart with four columns.

- In the first column, list at least five different oils that you have eaten or used in the past week.
- In the second column, describe how you used each oil.
- In the third column, describe how each oil is produced.
- In the fourth column, identify the following: where the plants that each oil is extracted from are grown OR how the animals that each oil is extracted from are raised.

Plan your explanation.

- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.
- Make a list of at least five oils you eat or use and think about how you use each one.
- Do some research using credible sources to learn about how the oil is made and where it is grown/raised and produced.

Create your chart.

- Use your notes to create your four-column chart on a separate sheet of paper or poster board.
- Use drawings, descriptions, photographs, or other graphics to help make your chart appealing and understandable.
- Read your chart over carefully to make sure it clearly describes how each oil is used and where it comes from.
- Compare your chart with someone else's, and discuss how they are the same and different.
- Attach this page to the front of your chart when you turn it in.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	Product contains incomplete or missing information.	Product contains limited information about each oil.	Product contains a comprehensive list of oils with thorough explanation of uses and origins.	
Argument	Statements are unclear about oil purpose or origin.	Statements include descriptions of purposes and origins of the oils.	Product uses graphics and words that give a complete understanding of the purposes and origins of the oils.	
Organization	The work contains disorganized information that is difficult to follow or is incomplete.	The work contains a complete chart but with confusing information.	The complete chart is supported by graphics that thoroughly and understandably explain purposes and origins of oils.	
Grammar and mechanics	The work contains several errors or omissions.	The work contains some errors.	The work contains very few or no errors.	

Additional Feedback Notes:

Science Literacy Exercise Page 2

Use with Reading Collection 2

Roadmap for Reading

This week's reading collection focuses on the unintended consequences that happen when ecosystems are disrupted.

Collection 2: "Changing Ecosystems" consists of five selections.

- 1 From *The Log from the Sea of Cortez*
- 2 The History of Ecology
- 3 Habitat Fragmentation
- 4 Native, Non-Native, and Invasive Species
- 5 Right Whales, Wrong Place, Wrong Time

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Create a story about an unintended consequence after an ecosystem has been disrupted.

- The beginning should describe the ecosystem before the disruption.
- The middle should explain how and why the ecosystem was disrupted.
- The end should describe the results of disruption and the unintended consequence.

Plan your narrative.

- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.
- Make a list of at least three possibilities of unintended consequences in an ecosystem in which a non-native animal or plant is introduced to solve a problem, land is developed, or resources are extracted.
- Do some research using credible sources to learn more about unintended consequences in ecosystems. These may be events that happened in the past or are currently happening. They may be local or global.
- Choose one story to tell.

Create your narrative.

- Use your notes to create your story.
 - In the beginning, describe the ecosystem, and explain the reason for the disruption.
 - In the middle, relate how the ecosystem was disrupted.
 - As a conclusion, tell the results of the disruption and what the unintended consequence was. Then explain how the ecosystem adapted or did not adapt to the unintended consequence.
- Use drawings, descriptions, photographs, or other graphics to help make your story appealing and understandable.
- Read your story over carefully to make sure it clearly describes the ecosystem before, during, and after a disruption that caused an unintended consequence.
- Compare your story with someone else's, and discuss how they are the same and different.
- Attach this page to the front of your story when you turn it in.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The work exhibits incomplete or missing information.	The work includes a basic story about an ecosystem.	The work presents an engaging story about how an ecosystem was disrupted and an unintended consequence that occurred as a result.	
Argument	The work does not have a clear beginning, middle, or ending.	The work relates what happened with minimal detail.	The work uses graphics and words that relate the experience with a clear purpose.	
Organization	The work lacks basic structure of a beginning, middle, and ending.	The work includes a beginning, middle, and ending.	The work contains a compelling beginning, dramatic climax, and meaningful conclusion.	
Grammar and mechanics	The work contains several errors or omissions.	The work contains some errors.	The work includes few or no errors.	

Additional Feedback Notes:

Name: _____

Date: _____

Science Literacy Exercise Page 3

Use with Reading Collection 3

Roadmap for Reading

This week's reading collection focuses on estimating population sizes of unwanted animals in a human living area.

Collection 3: "Counting and Sampling Populations" consists of four selections.

- 1 School Study: Grasshopper Population
- 2 What Are Transects?
- 3 Counting Animals
- 4 Science Interviews Podcast

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Make a poster that shows the different ways to determine if there is a sizable unwanted animal population in a living space.

Plan your poster.

- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.
- Make a list of at least five animal species that infest people's homes. These might include insects, birds, rodents, small mammals, amphibians, or reptiles.
- Choose one of those animals to research.
- Do some research using credible sources to learn more about what signs indicate that the animal is living in a particular location.
- Continue your research to find out how to estimate the size of the animal population in a living area.

Create your poster.

- Use your notes to create your poster. You might want to outline it or draft it on another sheet of paper.
- Gather and organize materials and information to describe the unwanted animal.
- Explain why the animal is unwanted.
- Identify the evidence that indicates an unwanted animal population is living in a certain area.
- Explain the ways to determine how large the unwanted animal population is in a certain area.
- Use drawings, descriptions, photographs, or other graphics to help make your poster appealing and understandable.
- Read your poster over carefully to make sure it clearly describes the unwanted animal and how to estimate its population in a living area.
- Compare your poster with someone else's, and discuss how they are the same and different.
- Attach this page to the front of your poster when you turn it in.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The product exhibits incomplete or missing information.	The product contains a basic description of an animal and evidence of its presence.	The product is an engaging poster that clearly describes an unwanted animal and evidence of its presence.	
Argument	The product does not explain the animal or describe evidence of the animal's presence.	The product contains supporting evidence.	The product uses compelling graphics and words that reinforce the message.	
Organization	The product is disorganized and difficult to follow.	The product includes all basic parts of the assignment.	The product shows thoughtful, clear organization that engages the reader.	
Grammar and mechanics	The work exhibits errors or omissions.	The work includes some errors.	The work shows few or no errors.	

Additional Feedback Notes:

Science Literacy Exercise Page 4

Use with Reading Collection 4

Roadmap for Reading

This week's reading collection focuses on how species population size is affected by other species and interactions in an ecosystem.

Collection 4: "Population Dynamics" consists of five selections.

- 1 Leave Nature Alone
- 2 Harmony in Nature
- 3 The Bottleneck Effect
- 4 Strategies for Survival and Reproduction
- 5 Extinction Events

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Create a science fiction story about a mass extinction.

- The beginning should describe the ecosystem before the event that caused the mass extinction.
- The middle should explain how and why the event that caused the mass extinction occurred.
- The end should describe what Earth is like after the mass extinction.

Plan your narrative.

- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.
- Research different reasons for mass extinctions of the past.
- Review the selections, and think about how populations are affected by interactions in the environment.
- Decide on a time and place for your story and the reason for the mass extinction.

Create your narrative.

- Use your science knowledge to create your story.
 - In the beginning, describe Earth's ecosystem before the mass extinction.
 - In the middle, explain the event that caused the mass extinction.
 - In the conclusion, describe the Earth following the mass extinction, including which organisms did or did not adapt to the changes in the ecosystem.
- Use drawings, descriptions, photographs, or other graphics to help make your story appealing and understandable.
- Read your story over carefully to make sure it clearly describes the Earth before, during, and after an event that caused a mass extinction.
- Compare your story with someone else's, and discuss how they are the same and different.
- Attach this page to the front of your story when you turn it in.

Science Literacy Exercise Page 4, Continued

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The work exhibits incomplete or missing information.	The product includes a basic explanation of causes and effects of a mass extinction.	The product is an engaging story that clearly describes what happens to Earth after a mass extinction occurs.	
Argument	The product does not base content on scientific knowledge or evidence.	The product exhibits minimal use of scientific understanding.	The work is based on scientific understanding of how and why mass extinctions occur.	
Organization	The work is disorganized and difficult to follow.	The work includes a beginning, middle, and end.	The work is organized in a suspenseful way that keeps the reader engaged.	
Grammar and mechanics	The work exhibits errors or omissions.	The work includes some errors.	The work includes very few minor or no errors.	

Additional Feedback Notes:

Name: _____

Date: _____

Science Literacy Exercise Page 5

Use with Reading Collection 5

Roadmap for Reading

This week's reading collection focuses on how species population size is affected by other species and interactions in an ecosystem.

Collection 5: "Valuing Ecosystems" consists of four selections.

- 1 Bans, Boycotts, and Bargains
- 2 Stability through Diversity
- 3 Selectivity in Logging and Fishing
- 4 Tillman Marsh Town Hall

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Write a short historical account of agriculture.

- Describe early agriculture practices.
- Explain how agriculture developed over time.
- Describe current agricultural practices.

Plan your historical account.

- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.
- Research and take notes on the history of agriculture in general. Make sure to record where you got your information.
- Consider focusing in on a specific location or a specific product or crop, such as sheep, chickens, palm oil, bananas, corn, cotton, or potatoes. Research a topic, and record where you got your information.
- Narrow the focus of your historical account.

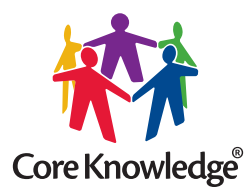
Create your historical account.

- Use your notes and what you have learned from the selections to write your historical account.
 - In the beginning, describe the early agricultural practices used for the topic of your historical account.
 - Then explain changes in practices to supply more and more people.
 - Next, describe current agricultural practices, which include monoculture.
 - Finally, discuss the advantages and disadvantages of the current agricultural processes.
- Use drawings, descriptions, photographs, or other graphics to help make your historical account appealing and understandable.
- Read your historical account over carefully to make sure it clearly and accurately describes the history of agricultural practices.
- Compare your historical account with someone else's, and discuss how they are the same and different.
- Attach this page to the front of your story when you turn it in.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The work exhibits incomplete or missing information.	The work provides basic details.	The work provides comprehensive historical information.	
Argument	The work does not clearly explain agriculture history.	The work includes minimal discussion of historical events.	The work includes thoughtful discussion of historical events.	
Organization	The work is disorganized and difficult to follow.	The work includes basic chronological information.	The work provides engaging and clear development of agricultural practices.	
Grammar and mechanics	The work exhibits several errors or omissions.	The work includes errors.	The work includes very few minor or no errors.	

Additional Feedback Notes:



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