ASSOCIATION OF ZOOS & AQUARIUMS
EDUCATION STATISTICS*

CONSERVATION AND RESEARCH
700 species benefiting from conservation action
375 species studied through mission-based research

EDUCATIONAL PROGRAMMING
Supporting classroom-based learning
51 million elementary, middle and high school students participated in education programs
91 MILLION participants in programs that focus on actions to address conservation issues

SUPPORTING STEM
STEM programming reached 2.3 million participants
Over 5 million spent on STEM Education

*Details provided by the Association of Zoo and Aquariums 2015 highlights annual report.
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LouisvilleZoo.org
LETTER FROM THE STAFF

The Zoo in 3D, Professional Learning Summit

Teachers,
Thank you for joining us for The Zoo in 3D Professional Learning Summit!

Today's program is the culminating event of the combined efforts of a dedicated group of teachers, administrators, university staff, and Zoo education professionals to create a set of experiences that will support science learning for teachers and students from around the State.

The Louisville Zoo has a rich history in our region, and as the State Zoo of Kentucky, it is one of only 250 Accredited Zoos & Aquariums in the United States. Since opening in 1969, the Zoo has made it our mission to “better the bond between people and our planet”. Our MetaZoo Education Center has been a centerpiece of that mission for over 30 years, and has performed hundreds of educational classes, supported thousands of teachers, and created millions of memories through our up-close, nose-to-nose experiences with our animal ambassadors.

We believe in the power of educating children through experience and through the discovery of the natural world using questioning, observation and exploration. We are the ultimate outdoor classroom, and with the support of local universities, conservation organizations, and field scientists, we strive to inspire children to take conservation action to enact change in their world.

Thanks to a generous gift from Genentech, Inc. we have many new exciting materials to share with you, and hope that at the end of this program you will learn what makes the Zoo a phenomenal resource for you students’ learning and discover the many ways the we can support your classroom.

We hope you enjoy the program and we hope to see your students in the 2017-18 school year!

John Walczak
Director
Louisville Zoo

Kim Allgeier
Curator of Conservation Education
Louisville Zoo

Advisory Team Members

Front (Left to Right)
Jennifer Payne
8th Grade Science, Daviess County Middle School
Dr. Tom Tretter
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Elementary Science Goal Clarity Coach
Jefferson County Public Schools
Animals and Their Environments

Overview

This overview is intended to provide a quick summary of the project: Animals and Their Environment. For each unit you will find a short description, learning goals, and learning experiences. For a more in depth description and completed procedures, including necessary materials, you will need to reference the standard and subsequent resources.

UNIT 1

3-LS1 From Molecules to Organisms: Structures and Processes

*This Unit focuses on an orangutan study and highlights the relationships between animals and their environments. Individual experiences in this unit may be done together or independently but are written to be completed in the order in which they appear so students’ knowledge builds over time. It is at the discretion of the teacher to decide how long each activity in the unit should take, based on their students’ needs.

Learning Goals

• Conceptualize life cycle of orangutan
• Conceptualize life cycle of trees (specifically oil palm)
• Model the relationship and/or impact the orangutan and palm oil plant have on each other
• Recognize unique patterns within orangutan species
• Recognize unique patterns within oil palm plantations

Overview

• Experience 1: Students will begin their exploration by investigating and observing photographs of orangutans in their natural habitat. The teacher will guide them to look closely as they shift focus from the whole image to isolated parts of the image creating a foundation for learning. Supported SEPs & CCCs:
  o Practice 4: Analyzing & Interpreting Data
  o Practice 6: Constructing Explanations
• Experience 2: Students will make real-world connections through text. Using Baim’s Story, students will be introduced to a rescued orangutan, and will complete a “What I know, What I Wonder” chart. Supported SEPs & CCCs:
  o Practice 8: Obtaining, evaluating, and communicating information
• Experience 3: As a class, students will read an informational text on orangutans. They will then work in small groups to identify information that relates to their “What I know/What I Wonder” chart and label information that can be investigated through observation. They will also create a life cycle timeline. Supported SEPs & CCCs:
  o Practice 1: Asking Questions
  o Practice 4: Analyzing & Interpreting Data
• **Experience 4:** As a class, students will read the informational text, Life Cycles of Trees. Students will participate in a model of a tree’s life cycle. Grouping students into groups of six, each student will use his/her body to represent one stage of the life cycle. Supported SEPs & CCCs:
  - Practice 2: Developing & using models
  - Cross Cutting Concept 1: Patterns

• **Experience 5:** Students will continue their exploration by discovering the relationship between the orangutan and oil palm. Students will first read an introduction to the oil palm, learning about the uses and needs of the oil palm to thrive. Students will then participate in the Oil Palm Model. This model is designed to highlight the impact the tree is having on the orangutan habitat. Supported SEPs & CCCs:
  - Practice 2: Developing & using models
  - Cross Cutting Concept 7: Engaging in an argument from evidence

**UNIT 2**

3-LS2 **Ecosystems: Interactions, Energy, and Dynamics**

*This unit is a two-part unit; the first part is a comparison between the social behaviors of two great ape species. Throughout Unit 1 students will have gained information about the orangutan species, providing an excellent foundation as they extend, revise, and create new opportunities for learning to occur. Part two is their Zoo Field Study. During their field study students will investigate behavioral predictions. Students will also analyze data they collected to justify observed behaviors. Individual activities in this unit may be done together or independently but are written to be completed in the order in which they appear so students’ knowledge builds over time. It is at the discretion of the teacher to decide how long each activity in the unit should take, based on their students’ needs.*

**Learning Goals:**

- Identify the disadvantages and advantages to living in groups
- Explain and understand the disadvantages and advantages to living in groups
- Categorize advantages/disadvantages of different social structures based on prior knowledge
- Analyze informational texts
- Be an active participant in inquiry-oriented classroom
- Record and Analyze Observations
- Construct an argument with collected data

**Overview**

- **Experience 1/ Part 1:** Students will watch two videos. Each video will feature either the orangutan or the gorilla living within its natural habitat. Students will be taking notes using the guiding questions provided. Here the students will begin to notice social patterns and relationships found in each great ape species. Supported SEPs & CCCs:
  - Practice 4: Analyzing and Interpreting Data
  - Cross Cutting Concept 1: Patterns
• **Experience 2/ Part 1:** Students will explore two information texts utilizing the W.I.N. comprehension strategy. After a class discussion about each text, students will begin to generate a list of advantages of living within a group. After only 3 – 5 whole group examples, the students will work with a partner to identify additional advantages. The information will be organized using a T-Chart. Supported SEPs & CCCs:
  o Practice 4: Analyzing and Interpreting Data
  o Cross Cutting Concept 2: Cause and Effect

• **Experience 3/ Part 1:** Students are asked to make predictions about behaviors they might see other animals that live within a group doing. These predictions will be investigated and researched during their Zoo Field Study. Supported SEPs & CCCs:
  o Practice 1: Asking Questions and Defining Problems

Part two is the Zoo Field Study. Activities may be completed in a different order than listed due to breakout observation group sessions. Also included is a Zoo Walk as they make their way to their observations.

• **Experience 1/ Part 2:** Students will be asked to recall and share their predictions about what behaviors they might see today as we observe animals that live within a group. As students share their predictions the zoo educator will encourage students to make their predictions are specific as possible. Several examples will be listed for the group to reference as they revise their predictions working in small groups. Supported SEPs & CCCs:
  o Practice 1: Asking Questions and Defining Problems
  o Practice 7: Engaging in Argument from Evidence

• **Experience 2/ Part 2:** Using the Zoo Map as a reference, students, now working in small groups, will choose a species they can observe that they believe lives within a group. After a species has been chosen students will work together to predict three observable behaviors. Students will record predictions. Supported SEPs & CCCs:
  o Practice 1: Asking Questions and Defining Problems
  o Practice 7: Engage in Argument from Evidence

• **Experience 3/ Part 2:** Break-out observations. Students will spend time observing their chosen species. They will be asked to record the observed behavior that justifies their prediction. If the predictions were not observed, they will be asked to record possible reasons those behaviors were not displayed. Note that just because a behavior was not observed doesn’t indicate their prediction was incorrect. Supported SEPs & CCCs:
  o Practice 3: Planning and Carrying Out Investigations
  o Practice 4: Analyzing and Interpreting Data
  o Cross Cutting Concept 2: Cause and Effect

• **Experience 4/ Part 2:** Students will be observing the lion and meerkat. Using an ethogram students will document observable behaviors. The students will take on the role of “researcher” throughout this activity. The question students will be researching is, “The lion and meerkat are both animals that live within a group. However, the purpose of their social groups is very different. Using the data you gather through your observations, predict the purpose for each social group.” Supported SEPs and CCCs:
  o Practice 7: Engaging in Argument from Evidence
  o Cross Cutting Concept 1: Patterns
o Cross Cutting Concept 2: Cause and Effect

- **Experience 5/ Part 2: (Post Lunch break)** Prior to this discussion students have been working in groups, for the remainder of the Field Study students will explore in a whole group setting. The zoo educator will guide students through inquiry based discussions on the findings of their research, (allowing students to explore ideas, clarify their thinking, consider different theories, and challenge one another’s view). As they do so students will build a shared understanding about the data and concepts. Supported SEPs and CCCs:
  o Practice 6: Constructing Explanations and Designing Solutions
  o Practice 7: Engaging in Argument from Evidence
  o Cross Cutting Concept 2: Cause and Effect

- **Experience 5/ In class ELA – Writing an Opinion Piece:** Students will utilize the data and information they have explored throughout Unit 2 to complete an opinion writing assignment. Using the graphic organizer provided students will be asked:
  o Based on your observations and research construct an argument that supports your opinion: If a species could choose to live solitary or live with a group, which do you believe would be the wiser choice?

**UNIT 3**

3-LS3 Heredity: Inheritance and Variation of Traits

*In this unit students will participate in a research project on different bear species. Staying in the same groups, students will assign roles to each other; Leader, Recorder, Time Keeper, and Presenter. The students will use a combination of provided informational texts and independent research to create a poster presentation about their specific bear species. After completing their bear research, students will be introduced to our polar bear Qannik and become familiar of her needs. Students will also learn how Qannik came to the Zoo. Combining the information they learned about other bear species and Qannik, students will create/design a polar bear exhibit. Individual activities in this unit may be done together or independently but are written to be completed in the order in which they appear so students’ knowledge builds over time. It is at the discretion of the teacher to decide how long each activity in the unit should take, based on their student’s needs.*

**Learning Goals:**

- Working in small groups students will develop a lists describing animal characteristics
- Research the cause-and-effect relationship between a species and its environment
- Design presentation on assigned bear species
- Design Louisville Zoo exhibit to meet the needs of Qannik, our rescued polar bear cub

**Overview:**

- **Experience 1:** Students will be using a combination of provided informational texts and independent research to complete a Bear Species Presentation. Students will be working in groups to research their specific bear species. The presentations will include information on the bear’s diet, habitat, physical characteristics, a labeled world map, and any other interesting facts. Presentations will be presented and discussed. Supported SEPs & CCCs:
• **Experience 2:** Students will compare and contrast their species of bear to the other five species presented. Using the Tour the Bears guiding questions, student will not only recognize differences and similarities but be explain why those relationships might exist. Supported SEPs & CCCs:
  o Practice 6: Constructing Explanations and Designing Solutions
  o Cross Cutting Concept 2: Cause and Effect

• **Experience 3:** Students will learn about Qannik (our Louisville Zoo polar bear, and the reasons why U.S. Fish and Wildlife decided she needed to be rescued.) Combining the information they learned about other bear species and Qannik, students will create/design a polar bear exhibit. They will have guiding questions to help them design the best possible space. Supported SEPs and CCCs:
  o Practice 6: Constructing Explanations and Designing Solutions
  o Cross Cutting Concept 2: Cause and Effect

• **Experience 4:** Students will be asked to reflect on the following:
  If Qannik had to be relocated would your bear species be well suited, equally suited, or poorly suited to move into her habitat? Why or why not? Supported SEPs and CCCs:
  o Practice 4: Analyzing and Interpreting Data
  o Cross Cutting Concept 2: Cause and Effect

---

**Unit 4**

**3-LS4 Biological Evolution: Unity and Diversity**

*In this Outreach Program students will be participating in a food collection and survival investigation. We will focus on providing a rich inquiry-oriented classroom, the teachers will act as co-explorers and guides with the students. The students will practice discussion skills while participating in productive “fishbowl” activity. Giving them the opportunity to share, debate, and justify emerging ideas.*

**Learning Goals:**

• Students will participate in food collecting/ survival investigation
• Students will participate in inquiry based “fish bowl” discussion
• Students will connect concepts from investigations to real world application
• Students will meet MetaZoo animals and identify characteristics that impact survival

**Overview:**

• **Experience 1:** Food Collection Research. Using a variety of tools, students will be asked to collect as much “food” as possible. Some tools will be highly effective while others may prove to be more challenging. Students will record the outcome of their food collection. Supported SEPs and CCCs:
• **Experience 2:** Students will participate in a “fishbowl” discussion. Using the displayed data they gathered during their Food Collection Research, the educator will facilitate small group discussions that allow students to explore ideas, clarify their thinking, consider different theories, challenge one another’s view, and defend their own positions. Each group will have a specified topic for discussion. Students will make real-world connections through their guiding questions about survival. Supported SEPs and CCCs:
  - Practice 1: Asking Questions and Defining Problems
  - Practice 7: Engaging in Argument from Evidence
  - Cross Cutting Concept 2: Cause and Effect

• **Experience 3:** This activity will be partially happening without the students’ knowledge that they are engaged in a survival investigation. As the students are participating in the “fishbowl” discussions, student will be selecting candy from a bowl as it circulates the outer circle of the “fishbowl.” Once the discussions have been completed the educator will ask the students to reflect on the candy they chose and the candy that was left behind in the bowl. Create lists; what made the candy they chose desirable? What made the candy in bowl less desirable? The educator will lead the discussion to allow students to make real world connections. The class will generate a list of ways this investigation can apply to nature. Animals have made plenty of adaptations to survive including taste, smell, appearance, and size. Supported SEPs and CCCs:
  - Practice 4: Analyzing and Interpreting Data
  - Practice 7: Engaging in Argument from Evidence
  - Cross Cutting Concept 2: Cause and Effect

• **Experience 4:** Meet and Greet in MetaZoo Animals. Students will have the opportunity to meet several of our MetaZoo creatures, pulling together all the concepts investigated throughout Project; Animals and Their Habitat. Students will learn about each animal’s growth and development, social interactions, traits, and adaptations!

**End of Project Writing Activity**
3-LS1 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction and death. [Clarification Statement: changes organisms go through during their life from a pattern (Assessment Boundry: Assessment or plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.)]

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
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</table>
| **Modeling in 3-5 builds on K-2 experience and progresses to represent events and design solutions.**  
- Develop models to describe phenomena (3-LS-1) | **LS1.B: Growth and Development of Organisms**  
- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1) | **Patterns**  
- Patterns of change can be used to make predictions (3-LS1-1) |
| **Connections to Nature of Science**  
Scientific Knowledge is based on Empirical Evidence  
- Science findings are based on recognizing patterns | | |

Connects to other DCIs in third-grade: N/A

Articulation of DCIs across grade levels: MS.LS1.B (3-LS1-1)

**Common Core State Standards Connections:**

ELA/Literacy —

**RI.3.7** Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where when, why and how key events occur). (3-LS1-1)

**SL.3.5** Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enrich certain facts or details. (3-LS1-1)

Mathematics —

**MP.4** Model with mathematics (3-LS1-1)

**3.NBT** Number and Operations in Base Ten (3-LS1-1)

**3.NF** Number and Operations—Fractions (3-LS1-1)
3-LS1-1 From molecules to Organisms: Structures and Processes

3-LS11. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Learning Goals:
- Conceptualize life cycle of orangutan
- Conceptualize life cycle of trees (specifically Oil Palm)
- Model the relationship and/or impact the orangutan and palm oil plant have on each other
- Recognize unique patterns within Orangutan species
- Recognize unique patterns within Oil Palm Plantations

UNIT 1 PROCEDURES
These procedures are not intended to be completed in one day. The separate components of this Task may be broken up at teacher's own discretion.

1. Explain to students that they will be starting an investigation on orangutans. Display a picture of an orangutan in its natural habitat and allow the students a few moments to make some general observations. Pictures found on page 15 – 16.
   - Have students take a “macro” view of the whole scene, then have them shift their focus to a close up view of a small area, extending from “green” level questions: who, what, when, why, how, to more complex questions.

Possible Guided Inquiry Questions;
- What do you notice?
  - How would you describe what you see? Extending with “green” level question: who, what, where, when, why, how
  - What more do you notice when you shift your perspective?
  - Have students take a “macro” view of the whole scene. Then have them shift their focus on a close up view of a small area.

2. Give students time to read The Story of Baim, a rescued infant orangutan. Some students may be able to continue independently to complete the “What I Know, What I Wonder” chart; some may require small group instruction.

3. Group students into small groups (2 – 3 students) to work together to read “Orangutans Facts” and complete the “Post Read Engagement.” Students will need to reference their “What I Know, What I Wonder Chart” during this activity.

4. Introduce the life cycle of trees using Classroom Newsletter, stopping at the end of the Life Cycle section on page one. Six phases of the plant life cycle are identified in this text; group students into groups of 6. Ask each child to use their body to model each phase of life. Example: the seed may be curled into a small “pod” on the ground, the sprout, seedling, and sapling may demonstrate the steams reaching toward the sun and the roots extending downward searching for water and nutrients, the mature tree should show three distinct parts, including the crown, trunk and root systems, and the decline may show branches breaking off or the tree slowly breaking down.

5. Continue working through “Life Cycle of Trees” to discover the relationship that the orangutan and the oil palm share. Engage students in discussions. Suggested discussions found within
6. Have students participate in the Orangutan/Oil Palm Model (procedures separate, found on following pages).

**Additional Resources:**
This link will take you directly to The Louisville Zoo Backyard Action Hero, Tropical Rainforest. It has excellent articles that can easily be incorporated into your literacy block that support the ideas and knowledge gained throughout Unit 1.
Somehow, in the long day and night that he was rescued and given to WWF’s care, my little “man of the forest”—a tiny baby orangutan with a nimbus of red hair—managed to lodge himself in my heart.

I met Baim—incongruously named after an Indonesian celebrity—in the Heart of Borneo, a forest region on the island of Borneo. Baim was in a cardboard box lined with newspapers and crying for his mother, terrified to be without her and surrounded by strangers in a place far from home. We locked eyes as his fingers desperately clung to mine.

He should’ve been latched on to his mother instead, knowing that she would be there for comfort and nourishment. He should’ve had years of learning from her ahead of him—what to eat, how to build nests, where to find his kind. His playground should have been the tree tops of shady forests until he matured into an adult.

Instead he faced a future that would take him deeper into human territory before offering any hope for a return home to the forest.

The Road to Rescue
Baim’s cries were heard by two men hunting for frogs in the forest. They waited four hours for his mother to return. The men knew that a mother orangutan would never willingly leave her infant behind and was instead likely the victim of poachers, so they took Baim to their longhouse. They could’ve sold him into the pet trade, but chose to hand him over to the national park ranger who notified WWF staff.

After meeting with senior district officials, WWF was given responsibility to take Baim to the provincial headquarters. There he was placed in a rehabilitation center.

For most of the five hours bumping over rough roads to the nearby town, he squeezed his eyes shut and clutched my finger, pulling it close to his face. That night he was inconsolable in his makeshift crib until he found a safe place in the crook of my arms. We both fell into an exhausted sleep on the floor of the WWF office.

Saying goodbye the next day was not easy.
I was embarrassed to cry in front of the staff as I held Baim close one last time before leaving for the airport to fly back to my family in the U.S. Before leaving, I whispered in his ear that I’d pray he would one day find his way back home too.

Baim now lives with more than a dozen other orangutans in Ketapang Orangutan Centre of International Animal Rescue. He will grow to adulthood there and like the others, wait for a future that will return him to the forest.

Securing a Future for Orangutans
Progress is being made to protect orangutans and their homes. In 2007, the governments of Indonesia, Malaysia and Brunei signed a historic agreement to save the Heart of Borneo. WWF is working with these nations to conserve 85,000 square miles of rain forest—about the size of the state of Utah—through a network of protected areas and sustainably-managed forests.

Indonesian President Yudhoyono also outlined a national strategy in 2007 to protect orangutans, stating that by 2015 all orangutans still in rehabilitation centers would be returned to the wild. What we need now is to move good intentions to real action. It’s the only way to ensure that Baim will have a place to call home.

**What I Know, What I Wonder**

*Student Resource 2: Unit 1*

**Directions:**
After reading *The Story of Baim*, the rescued orangutan, complete the chart. In the “What I know” column write a list of a few interesting facts you learned about orangutans. In the “What I Wonder” column write a list of questions you have that interest you about orangutans.

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<th>WHAT I KNOW</th>
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1. Orangutans are red-haired apes that live in the tropical rainforests of Sumatra and Borneo in Southeast Asia.

2. These magnificent mammals measure 1.2m to 1.5m tall and weigh up to 100kg. And they have one seriously big arm span – some males can stretch their arms 2m from fingertip to fingertip!

3. The orangutan is one of humankind's closest relatives – in fact; we share nearly 97% of the same DNA! The word orangutan comes from the Malay words “orang hutan”, meaning “human of the forest”.

4. Orangutans spend most of their time up in the trees, where they use their long, strong arms and hook-shaped hands to climb and swing from branch to branch. Come bed time, they sleep in leafy nests high off the ground, where it's harder for hungry enemies (such as leopards and other big cats) to get them!

5. Daytime eaters, their diet consists mostly of fruit and leaves – but they also eat nuts, bark, insects and, once in a while, bird eggs, too.

6. Female orangutans give birth about once every eight years. Infants stay with their mother for six to seven years, until they've learnt the necessary skills to survive on their own. During this time, a very special bond is formed between the mother and child.

7. Unlike other great apes, such as chimpanzees, gorillas and bonobos, these gangly guys don’t like to live in groups. A female will usually have a baby (or two) with her, but males like to be alone.

8. Orangutans are noisy creatures when they want to be, making loud howls and bellows that can be heard for miles around! It's usually the males that make these calls so that they can stay out of each other's territory.

9. These amazing apes generally have long lives – in captivity they can live for 50-60 years, and in the wild, 30-40 years.

10. Sadly, orangutans are today on the endangered species list. Deforestation in the forests where they live has reduced their habitat, and illegal hunting has put populations at serious risk.

Reproduced from Natgeokids.com/uk/discover/animals/general-animals/ten-facts-about-orang-utans
For Task 1 you will need your completed “What I know/ What I Wonder” chart. To complete Task 2, refer to the Orangutan Fact Sheet.

**TASK 1**

Look back at your “What I Wonder” chart used in Baim’s Story.

Place a ⭐ next any information that can support your “wonder” questions.

**TASK 2**

Fill in the missing information:

1. Orangutans live in ________________________________ of Sumatra and Borneo.

2. Orangutans spend most of their time up in ____________________________.

3. Female orangutans give birth about every _____ years.
   Infants stay with their mother for _____ to _____ years.

4. Unlike other great apes, such as chimpanzees, gorillas and bonobos, these gangly guys don’t like to ____________ ____________ ____________.

5. These amazing apes generally have long lives; in managed environments they can live for _____ years, and in the wild, ________ years.
Dear Explorers,

We have spent time investigating orangutans and what makes them unique and diverse. Now, let’s explore a tree that is making a big impact on the orangutan’s future. As with all living things, just like we have learned about the orangutan, trees have a life cycle. In order for the tree to complete its life cycle it will need:

- Adequate space
- Water
- Nutrients
- Sunlight for the individual species

No matter the type of tree, all trees start from seeds and the life cycle is about the same.

**SEEDS**

Seeds come in a wide variety of shapes, weights, colors, and sizes, depending on the species. Some seeds are contained in a protective nut like an acorn, pecan, or hickory. Other seeds are found in fleshy fruits, like the palm fruit, black cherry, or persimmon. Wind, water, animals, and people disperse seeds to many types of landscapes.

**SPROUT**

If all the seed’s needs are met the embryo will begin to grow. Roots will grow downward to anchor the sprout and search for water and nutrients. The sprout will grow upward seeking sunlight.

**SEEDLING**

This stage is when a tree is the most susceptible to being killed. Weather, flood, drought, insect attacks, and being eaten by animals all threaten its survival. To survive the seedling will also have to compete for nutrients, water, sunlight, and space.

**SAPLING**

Saplings are juvenile trees that are not ready to reproduce. Trees in this phase will encounter the same problems as the seedling however they grow rapidly in this phase.

**MATURE TREE**

A mature tree will have 3 distinct parts, including the crown, trunk and root systems. In addition, flowers develop, reproduction ensues, fruits form, and seed dispersal can now occur.

**DECLINE/DECOMPOSITION**

Like all living things, trees will die. Decomposition takes time. A standing dead tree, also called a snag, will slowly break down and return nutrients to the soil as small limbs, bark, and branches fall to the ground.
THE OIL PALM
Oil palms are palm trees which grow hundreds of little orange/red fruits that are squashed, squeezed and pulped to produce palm oil. Palm oil is a type of vegetable oil harvested in Malaysia, Indonesia, and West Africa. Palm oil is found in absolutely everything from food and household products, to make-up and other cosmetics. Some examples of products that may contain palm oil include lipstick, pizza dough, shampoo, ice cream, chocolate, cookies, soap, etc.
Since oil palms need a rainforest climate — constantly high humidity and temperatures — and a lot of land, plantations are often established at the expense of rainforests.

DISCUSSION
Review the needs that all trees need to thrive. What do you think is happening to the rainforests and why?

What do you predict will happen as the demand for palm oil increases?

Adequate space is needed to plant the palm trees that will make the oil. Valuable trees are harvested and the rest of the land is burnt to clear the land for the farming of palm oil. Each time they are done with an area, they burn more and more. The oil palm will start bearing fruits at 2 – 3 years old and will continue to do so for the next 20 – 25 years.

Call to Action
The Roundtable on Sustainable Palm Oil (RSPO) developed a set of environmental and social criteria which companies must comply with in order to produce Certified Sustainable Palm Oil (CSPO).

Making a Difference
As an individual and a consumer, you can;

- Raise awareness of the RSPO and CSPO
- Tell companies that you want to see them use products that CSPO rather than conventional palm oil
- Support companies that are already committed to CPSO

Remember your voice matters.
Objective

Model the relationship the oil palm is having on the orangutan species.

What You’ll Need

• Approximately 130 pieces of “food” (worksheets provided)
• A large indoor or outdoor area
• 8 orangutan cards (provided)
• Graph (provided)
• Red X cards (provided)
• Yarn or tape to create rainforest boundaries

The Set-up

Step 1:
Create a “rainforest” to demonstrate the relationship between the orangutan and the oil palm. Using tape or string, make a large circle and divide it into 8 equal sections (creating a “pie” shape on the ground). If available to you, you may also lay 8 hula hoops on the ground so that they make a circle. In either set up, there should be clear boundaries between each section. See diagrams below for set up options.

Step 2:
Cut out provided pictures of food (provided) and place them in each section according to the information below:

• 12 pieces (3 sections)
• 14 pieces (3 sections)
• 16 pieces (2 sections)

Step 3:
Identify 8 students who will be the “orangutans” that will live within each section. Label the students with an orangutan card (provided). Each card identifies an individual orangutan at a different life phase, and provides information about their sex, and amount of resources (food), they need to survive.

The 8 individual orangutans are:

• Adult Male (2 students) 8 pieces of “food” per round
• Young Adult Female (1 student) 4 pieces of “food” per round
• Young Adult Male (1 student) 4 pieces of “food” per round
• Female with young (2 students) 6 pieces of “food” per round
• Pregnant female (1 student) 5 pieces of “food” per round
• Senior adult (1 student) 3 pieces of “food” per round

Procedure:
Round 1
Once food has been placed in each area, randomly assign students to 1 of the 8 sections. Each student will be asked to pick up the resources that they need to survive but they MUST stay inside of their section, and they must collect in order based on the hierarchy below. Once they have collected their food, ask each student to confirm if they were able to find all of the food they needed. Record their answers on the graph provided or create one of your own.

Once student results are recorded, ask them to replace their collected food and step out of the rainforest.

Collection hierarchy: ask students to collect their food in this order for each round.

1. Adult Male 1
2. Adult Male 2
3. Young Adult Female
4. Young Adult Male
5. Female with Young 1
6. Female with Young 2
7. Pregnant Female
8. Senior Adult

Round 2: Rainforest Clearing
When the students have left the rainforest, randomly select 1 of the 8 sections to “clear” for an oil palm plantation by placing a red X (provided) in the center of the section. Once the section has been “cleared”, no students may use it, and the food in that section should be removed and placed off to the side.

Ask students to return to the same section they were in for Round 1. The student that occupied the section that was “cleared” will need to choose a new section but THEY MUST CHOOSE A SECTION THAT IS ADJACENT TO THEIR ORIGINAL SECTION.

Using the hierarchy, instruct students to collect their resources. Do not move down the hierarchy list until the top ranking orangutan has collected his/her necessary resources.

Word track example:
- “Now that the Adult Males have collected their resources, the Young Adult Female may begin to collect hers.”
- “Now that the Young Adult Female has collected her resources, the Young Male may begin to collect his.”

Moving instructions
If the student that was displaced from their original section is unable to collect enough food in their new section, they may move to another adjacent section when their turn is called. If they choose to move, they must leave any collected food from the previous section. If the new area is unable to meet their needs, they must leave the rainforest.

If all students are able to collect their necessary resource refer back to rainforest clearing Instructions. Note: New “cleared” sections of rainforest should be adjacent to existing sections.

Once they have collected their food, ask each student to confirm if they were able to find all of the food they needed.

Ask students to predict what they think will happen in the next round.
Outcomes
If any students were unable to collect their necessary resources, the model is concluded.
If students were able to collect their necessary resources, the model may continue. Once student results are recorded, ask them to replace their collected food and step out of the rainforest.

With each new section of rainforest, “cleared” to make room for oil palm plantations, the students whose section was removed must move to an adjacent section to their own. Follow the Moving Instructions for each displaced student. If multiple students are moving, you may provide them 2 opportunities to move based on their hierarchy.

Discussion Questions:
• Why do you think you had to collect food in a certain order?
• Why do you think you were only able to move to an adjacent section?
• Why do you think you had to leave your collected food when you moved to a new section?
• Why do you think the sections of rainforest that were “cleared” for palm plantations were next to each other?

Place X in sections of the rainforest that have been cleared for oil palm plantations
Sample food items: Please note these food items represent the diet of the orangutan (their diet is made up of mostly fruit, leaves and insects) but they are not actual sources of food. This should be identified as a limitation for your model.

Food sets on following pages. You need approximately 130 individual pieces of food.
Sample Model ID

YOU ARE
ADULT MALE 1
YOUR NEEDS
COLLECT 8 PIECES OF
“FOOD” PER ROUND

YOU ARE
ADULT MALE 2
YOUR NEEDS
COLLECT 8 PIECES OF
“FOOD” PER ROUND

YOU ARE
FEMALE WITH
YOUNG 1
YOUR NEEDS
COLLECT 6 PIECES OF
“FOOD” PER ROUND

YOU ARE
FEMALE WITH
YOUNG 2
YOUR NEEDS
COLLECT 6 PIECES OF
“FOOD” PER ROUND

YOU ARE
YOUNG ADULT
FEMALE
YOUR NEEDS
COLLECT 4 PIECES OF
“FOOD” PER ROUND

YOU ARE
PREGNANT
FEMALE
YOUR NEEDS
COLLECT 5 PIECES OF
“FOOD” PER ROUND

YOU ARE
YOUNG ADULT
MALE
YOUR NEEDS
COLLECT 4 PIECES OF
“FOOD” PER ROUND

YOU ARE
SENIOR
ADULT
YOUR NEEDS
COLLECT 3 PIECES OF
“FOOD” PER ROUND
Sample Food Sheets

- Leaves
- Apples
- Bananas
- Bugs
After each round, mark each orangutan with a ✓ or X based on their ability to collect food.

<table>
<thead>
<tr>
<th>ORANGUTAN</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
<th>Round 4</th>
<th>Round 5</th>
<th>Round 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADULT MALE ORANGUTAN 1</td>
<td></td>
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<td>ADULT MALE ORANGUTAN 2</td>
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<td>YOUNG ADULT FEMALE ORANGUTAN</td>
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<td>YOUNG ADULT MALE ORANGUTAN</td>
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<tr>
<td>FEMALE ORANGUTAN WITH YOUNG 1</td>
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<tr>
<td>FEMALE ORANGUTAN WITH YOUNG 2</td>
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<tr>
<td>PREGNANT FEMALE ORANGUTAN</td>
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<tr>
<td>SENIOR ADULT ORANGUTAN</td>
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</tbody>
</table>
ANIMALS & THEIR ENVIRONMENTS

UNIT 2
3-LS2 Ecosystems: Interactions, Energy, and Dynamics

Students who can demonstrate understanding can:

3-LS2-1. Construct an argument that some animals form groups that help members survive.

The performance expectations above were developed using the following elements from NRC document A Framework for K-12 Science Education.

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaging in Argument from Evidence</td>
<td>LS2.D: Social Interactions and Group Behavior</td>
<td>Patterns Cause and Effect</td>
</tr>
<tr>
<td>• Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</td>
<td>• Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size (Note: Moved from K-2). (3-LS2-1)</td>
<td>• Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1)</td>
</tr>
<tr>
<td>• Construct an argument with evidence, data, and/or a model. (3-LS2-1)</td>
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</tr>
</tbody>
</table>

Connections to other DCIs in third grade: N/A
Articulation of DCIs across grade-levels: 1.LS1.B (3-LS2-1); MS.LS2.A (3-LS2-1)

Common Core State Standards Connections:

ELA/Literacy —
RI.3.1 Ask and answer questions to demonstrate understanding of text, referring explicitly to the text as the basis for the answers. (3-LS2-1)
RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS2-1)
W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS2-1)

Mathematics —
MP.4 Model with mathematics. (3-LS2-1)
3.NBT Numbers and operations in Base Ten (3-LS2-1)
3-LS2 Ecosystems: Interactions, Energy, and Dynamics

3-LS2-1. Construct an argument that some animals form groups that help members survive.

Learning Goals:
- Identify the disadvantages and advantages to living in groups
- Explain and understand the disadvantages and advantages to living in groups
- Categorize advantages/disadvantages of different social structures based on prior knowledge
- Analyze informational texts
- Be an active participant in inquiry-oriented classroom
- Record and analyze observations
- Construct an argument with collected data

UNIT 2 PROCEDURES

These procedures are not intended to be completed in one day. The separate components of this Task may be broken up at teacher’s own discretion.

In Class Pre-Lesson to Zoo Field Study

Explain to students that they will be observing two types of great apes; the gorilla and orangutan. During observations students will record data to be used to analyze the social structure of the great apes. Video observation form provided.

- Video: Family of Mountain Gorillas — Cousins — BBC: https://www.youtube.com/watch?v=ODyB9i6bGwQ

1. Students will be recording their observations on outline provided. Please provide two copies for each student, one for each video. Review questions prior to video so that students are aware of what they are looking and listening for.
   - After videos, display 3 talking points on board, using recorded observations students will “Think, Pair, Share”
   - What patterns or relationships did you notice with the orangutan? Gorilla?
     - Brainstorm 2 advantages of living within a group? Solitary?
     - Brainstorm 2 disadvantages of living within a group? Solitary?

2. Introduce the informational text, About the Western Lowland Gorilla. Using the W.I.N. strategy break the passages up and assign students individual section. Record. Share.

   - Introduce the informational text, About Orangutans. Using the W.I.N. strategy break the passages up and assign students individual section. Record. Share.

W.I.N. Strategy

- Who or what is the section mostly about?
- What is the most important Information about who or what?
- Write the main idea in a small Number of words.

4. Whole Group Discussion: After reading about gorillas and orangutans are you able to add to your video observations with greater detail?

5. Distribute Advantages T-chart. As a class have students share their thoughts on some of the advantages on living solitary and some of the advantages of living within a group. Record these ideas on the board, instruct students to fill in their T-chart.

LouisvilleZoo.org
6. To prepare for your Zoo Field Study, ask students to:
   • Using the information gathered during the great apes investigation, predict behaviors they might see other animal groups doing.
     o Sample answers; “The animals will be close together.” “The animals will be communicating.” “The animals will be working together to find food.”
     o Combine/Record Predictions on a Prediction Chart
       • Please bring predictions with you to your Zoo Field Study.

   In Class Post Field Study Writing Prompt
   Based on your observations and research, construct an argument that supports your opinion: “If a species could choose to live solitary lives or live within a group, which do you believe would be the wiser choice?”
     • Students will utilize provided Graphic Organizer to construct argument
     • Possible Extension: Divide class and allow for classroom debate
     • Share and Discuss
Video Observations
Student Resource 1: Unit 2

Check which animal you are observing. Review questions prior to beginning video observations. Record as many observations as you can, you may not be able to collect all suggested observations.

Please check which animal:  □ ORANGUTAN  □ GORILLA

1. About how many members are in a group?

2. About how many females are in a group?

3. About how many males are in a group?

4. Do they interact with each other? If so, when and why?

5. Do they work together to acquire resources?

6. How are the babies cared for?

7. Where do they spend most of their time?

8. Where do they find their food?
About the Western Lowland Gorillas

Western lowland gorillas are endangered, but they remain far more common than their relatives, the mountain gorillas. They live in heavy rain forests, and it is difficult for scientists to accurately estimate how many survive in Cameroon, Central African Republic, Congo, Equatorial Guinea, Gabon, Angola, and the Democratic Republic of Congo.

Western lowland gorillas tend to be a bit smaller than their mountain cousins. They also have shorter hair and longer arms.

Social Behavior
Gorillas can climb trees, but are usually found on the ground in communities of up to 30 individuals. These troops are organized according to fascinating social structures. Troops are led by one dominant, older adult male, often called a silverback because of the swath of silver hair that adorns his otherwise dark fur. Troops also include several other young males, some females, and their offspring.

The leader organizes troop activities like eating, nesting in leaves, and moving about the group’s 3/4-mile to 16-square-mile home range.

Those who challenge this alpha male are apt to be cowed by impressive shows of physical power. He may stand upright, throw things, make aggressive charges, and pound his huge chest while barking out powerful hoots or unleashing a frightening roar. Despite these displays and the animals’ obvious physical power, gorillas are generally calm and nonaggressive unless they are disturbed.

Diet
In the thick forests of central and west Africa, troops find plentiful food for their vegetarian diet. They eat roots, shoots, fruit, wild celery, and tree bark and pulp.

Reproduction
Female gorillas give birth to one infant after a pregnancy of nearly nine months. Unlike their powerful parents, newborns are tiny—weighing four pounds—and able only to cling to their mothers’ fur. These infants ride on their mothers’ backs from the age of four months through the first two or three years of their lives.

Young gorillas, from three to six years old, remind human observers of children. Much of their day is spent in play, climbing trees, chasing one another, and swinging from branches.

Reprinted from http://www.nationalgeographic.com/animals/mammals/w/western-lowland-gorilla
About Orangutans

Student Resource 3: Unit 2

The Malay word orangutan means “person of the forest.” These long-haired, orangish primates, found only in Sumatra and Borneo, are highly intelligent and are close relatives of humans.

Size
Orangutans have an enormous arm span. A male may stretch his arms some 7 feet from fingertip to fingertip—a reach considerably longer than his standing height of about 5 feet. When orangutans do stand, their hands nearly touch the ground.

Life in the Trees
Orangutans’ arms are well suited to their lifestyle because they spend much of their time (some 90 percent) in the trees of their tropical rain forest home. They even sleep aloft in nests of leafy branches. They use large leaves as umbrellas and shelters to protect themselves from the common rains.

Diet
These cerebral primates forage for food during daylight hours. Most of their diet consists of fruit and leaves gathered from rain forest trees. They also eat bark, insects and, on rare occasions, meat.

Solitary Behavior
Orangutans are more solitary than other apes. Males are loners. As they move through the forest they make plenty of rumbling, howling calls to ensure that they stay out of each other’s way. The “long call” can be heard 1.2 miles away.

Reproduction
Mothers and their young, however, share a strong bond. Infants will stay with their mothers for some six or seven years until they develop the skills to survive on their own. Female orangutans give birth only once every eight years—the longest time period of any animal. The animals are long-lived and have survived as long as 60 years in captivity.

Threats to Survival
Because orangutans live in only a few places, and because they are so dependent upon trees, they are particularly susceptible to logging in these areas. Unfortunately, deforestation and other human activities, such as hunting, have placed the orangutan in danger of extinction.

Reprinted from http://www.nationalgeographic.com/animals/mammals/group/orangutans/
After video observations, independently or with a partner come up with 2 advantages to living primarily solitary and 2 advantages to living within a group.

Before completing chart read both informational texts, use the information to help you predict additional advantages to each way of life.

<table>
<thead>
<tr>
<th>ADVANTAGES TO LIVING PRIMARILY SOLITARY</th>
<th>ADVANTAGES TO LIVING WITHIN A GROUP</th>
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</table>
### Teacher Answer Key

<table>
<thead>
<tr>
<th>ADVANTAGES TO LIVING PRIMARILY SOLITARY</th>
<th>ADVANTAGES TO LIVING WITH IN A GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Less competition for breeding</td>
<td>• Safety from predators</td>
</tr>
<tr>
<td>• No obligation to share food</td>
<td>• Co-operative Hunting</td>
</tr>
<tr>
<td>• Less competition for space</td>
<td>• Access to mate</td>
</tr>
<tr>
<td>• Hiding from predator</td>
<td>• Communal Care</td>
</tr>
</tbody>
</table>

**Sharing Information**
UNIT 3
3-LS3 Heredity: Inheritance and Variation of Traits

Students who can demonstrate understanding can:

3-LS3-1. **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

3-LS3-2. **Use evidence to support the explanation that traits can be influenced by the environment.** [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

The performance expectations above were developed using the following elements from NRC document: A Framework for K-12 Science Education.

### Science and Engineering Practices

<table>
<thead>
<tr>
<th>Analyzing and Interpreting Data</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
</thead>
</table>
| Analyzing data in 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) | **LS3.A: Inheritance of Traits**  
- Many characteristics of organisms are inherited from their parents. (3-LS3-1)  
- Other characteristics result from individuals’ interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2) | **Patterns**  
- Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1)  
- **Cause and Effect**  
- Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1) |
| **Constructing Explanations and Designing Solutions**  
Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2) | **LS3.B: Variation of Traits**  
- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)  
- The environment also affects the traits that an organism develops. (3-LS3-2) | |

### Connections to other DCIs in third grade: N/A

**Articulation of DCIs across grade-levels:**  
- **1.LS3.A (3-LS3-1)**  
- **1.LS3.B (3-LS3-1)**  
- **MS.LS1.B (3-LS3-2)**  
- **MS.LS3.A (3-LS3-1)**  
- **MS.LS3.B (3-LS3-1)**

**Common Core State Standards Connections:**

**ELA/Literacy –**

- RI.3.1 Ask and answer questions to demonstrate understanding of text, referring explicitly to the text as the basis for the answers. (3-LS3-1), (3-LS3-2)
- RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1), (3-LS3-2)
- RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1), (3-LS3-2)
- W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1), (3-LS3-2)
- SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1), (3-LS3-2)

**Mathematics –**

- **MP.2** Reason abstractly and quantitatively. (3-LS3-1), (3-LS3-2)
- **MP.4** Model with mathematics. (3-LS3-1), (3-LS3-2)
- **3.MD.B.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1), (3-LS3-2)
3-LS3 Heredity: Inheritance and Variation of Traits

3-LS3-2. **Use evidence to support the explanation that traits can be influenced by the environment.**

**Learning Goals:**
- Working in small groups students will develop a lists describing animal characteristics
- Research the cause-and-effect relationship between a species and its environment
- Design presentation on assigned bear species
- Design Zoo exhibit for polar bear cub

**UNIT 3 PROCEDURES**

These procedures are not intended to be completed in one day. The separate components of this task may be broken up at teacher’s own discretion.

Present the lesson as a problem:

The Zoo has discovered that a polar bear cub has been orphaned on the North Slope of Alaska. She needs a home, and the Zoo needs to create an exhibit to give her one. The Zoo has requested the help of the class to create the best possible home for this cub. To do so the class must research the question, “What does a bear need?"

1. Begin the discussion by making a chart indicating what a bear needs to survive
2. Designate six groups of four students. Each group will be responsible for creating a presentation on one of the listed bear species found in the text: giant panda bear, American black bear, Andean spectacled bear, Asiatic black bear, sloth bear, and sun bear.
   - As this text will not provide all necessary information for a successful presentation, please refer to the additional resources listed below:
3. Provide poster board, markers, pens informational text and time to research independently (possible idea: collaborate with your school’s computer teacher to allow time to research)
4. Present the graphic organizer and rubric to class. All necessary information required in the rubric can be found using a combination of the informational text and one of the listed reference sites.
5. Allow time for students to research, create and complete their presentation.
6. Following presentations, engage students in discussion:
   - What patterns did you notice?
   - How does it relate to what you already know or have observed?
   - How did the environmental factor influence the bear’s characteritics?
   - What were some of the observable differences and why?
   - What do you predict would happen if the environment changed?
   - What do all bears need?
7. Using the Touring the Bears student resource, instruct students to review their peer’s presentations and collect data. Students should complete this portion of the activity independently. To ease
congestion, have students “tour” the posters in small groups. Use activity to highlight patterns and relationships found between the bear species.

At this point, students should have formed a clear idea of what bears need to survive, and recognize the relationships between the bear’s habitat and the needs of that bear.

8. Introduce Qannik's story by reading “Meet Qannik the Polar Bear Cub” focusing on the following:
   - Why U.S. Fish and Wildlife Services decided she should be rescued
   - How changes to the environment due to climate change are impacting polar bear survival

Qannik has been with the Louisville Zoo since 2011 and is doing wonderfully in her home at Glacier Run. However, ask student to imagine that they are exhibit designers for the Zoo and are responsible for creating an exhibit where Qannik will live and thrive in her new home in Louisville.

**Exhibit Design challenge:**

Students may build their “exhibit” using any materials available including markers, pens, cardboard, clay, fabric scraps. Ideas include creating an architect’s blueprint, or a shoebox diorama. Please choose the best method you feel will work for your group. Give each student the Important Questions Student Resource. They should consider these questions prior to designing their exhibit. Allow students to share their designs and explain why their exhibit would be a perfect place for Qannik.

9. Following the Exhibit Design Challenge: Writing Prompt
   - If Qannik had to be relocated, would your bear species from the group research project be well suited, equally suited or poorly suited to move into her habitat? Why or why not?
<table>
<thead>
<tr>
<th></th>
<th>Needs Improvement (1 point)</th>
<th>Good Work (3 pts)</th>
<th>Great Job!! (5 pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habitat</strong></td>
<td>Incorrect or no information is provided about the bear's habitat. 0 facts presented/</td>
<td>Limited information is provided about the bear's habitat. 1–2 facts presented/</td>
<td>Research is complete and presented with care and thoughtfulness. 3 facts presented/</td>
</tr>
<tr>
<td></td>
<td>displayed</td>
<td>displayed OR Presentation is unclear/messy World Map Included with labeled habitat</td>
<td>displayed World Map Included with labeled habitat.</td>
</tr>
<tr>
<td><strong>Diet</strong></td>
<td>Incorrect or no information is provided about the bear's diet 0 facts presented/</td>
<td>Limited information is provided about the bear's diet. 1–2 facts presented/</td>
<td>Research is complete and presented with care and thoughtfulness. 3 facts presented/</td>
</tr>
<tr>
<td></td>
<td>displayed</td>
<td>displayed OR Presentation is unclear/messy</td>
<td>displayed</td>
</tr>
<tr>
<td><strong>Observable Physical Characteristics</strong></td>
<td>Incorrect or no information is provided about the bear's observable physical characteristics. 0 facts presented/ displayed</td>
<td>Limited information is provided about the bear's observable physical characteristics. 1–2 facts presented/ displayed OR Presentation is unclear/messy</td>
<td>Research is complete and presented with care and thoughtfulness. 3 facts presented/ displayed</td>
</tr>
<tr>
<td><strong>Other Interesting Facts</strong></td>
<td>Incorrect or no information is provided about the bear's lifestyle. 0 facts presented/ displayed</td>
<td>Limited information is provided about the bear's lifestyle. 1–2 facts presented/ displayed OR Presentation is unclear/messy</td>
<td>Research is complete and presented with care and thoughtfulness. 3 facts presented/ displayed</td>
</tr>
<tr>
<td><strong>Effort</strong></td>
<td>Work is not completed in a satisfactory manner. Student shows minimal effort. Student does not use class time effectively.</td>
<td>Completed work in an above average manner, yet more could have been done. Student needs to go one step further to achieve excellence.</td>
<td>Completed work with excellence and exceeded teacher expectations. Student exhibited exemplary commitment to the project.</td>
</tr>
</tbody>
</table>
Directions
The center will be the species of bear. In the surrounding areas please make sure you have researched information on the bear’s HABITAT, DIET, OBSERVABLE PHYSICAL CHARACTERISTICS, and OTHER INTERESTING FACTS. Your Poster should include at least 3 facts from each area and a world map with the habitat identified and labeled.
Brown bears are the most widely distributed species of bear in the world. Geologically speaking, bears have lived on every continent except Australia sometime in the past. The evolution of today’s bears can be traced back to around 30 million years ago. Today, there are eight living bear species. Ancestors of these living species of bears can be traced back to the Miocene Epoch, between 15 and 20 million years ago. The best known of these ancient bears and the first known member of the Ursidae—or “true bear” family—was the so-called cave bear.

This ice age predator, evidence of which has been found at several sites in Europe, was actually bigger than today’s grizzly bears. Interestingly, though, the teeth of this great bear indicate it was almost exclusively a vegetarian, which may have led to its extinction as ice sheets buried or destroyed local vegetation. Somewhere around 300,000 years ago, the cave bear began to roam to other parts of the world, likely looking for food. As groups moved into new areas and became more isolated from one another, new species began to develop, leading to the diversity of bears we see today.

Another ice age bear, whose history can be traced back two million years ago, was the giant short-faced bear. This species, which belonged to the genus Arctodus, may have been one of the largest and fiercest bears that ever lived. The short-faced bear stood between 11 to 13 feet tall on its hind legs and probably weighed between 1,800 and 2,000 lbs. Fossil evidence shows that it had eight-inch claws and fed almost exclusively on meat. This powerful species seems to have died out around 11,000 years ago. Its closest living relative today is the spectacled bear (Tremarctos ornatus) of South America.

**Living Bear Species**

Eight distinct species of bears can be found living on the planet today. Within the “town” borders of Glacier Run at the Louisville Zoo, you’ll find two of these species: polar bears (Ursus maritimus) and a subspecies of the brown bear (Ursus arctos) known as the grizzly bear (Ursus arctos horribilis). The six other species of living bears are 1) the American black bear; 2) the Asiatic black bear; 3) the spectacled or Andean bear; 4) the sloth bear; 5) the sun bear; and 6) the giant panda. Of these eight species, six are listed as either endangered or threatened.
Asiatic Black Bears
(Ursus thibetanus)
The scientific name of this medium-sized bear means “moon bear of Tibet.” The moon reference comes from the crescent-shaped yellowish marking found on its chest. These bears are also commonly called the Tibetan black bear and the Himalayan black bear. Males weigh between 220 to 440 pounds, and females are somewhat smaller, weighing between 110 to 275 pounds. They can be found across the southern part of Asia, into Pakistan, across northern Indian to the southern part of China. The Asiatic black bear has been seen at elevations as high as 13,000 feet, but generally comes down from the mountains during winter. They are omnivores and many are nocturnal, most active during the night. The typical territory of an individual Asiatic black bear is only about 0.5 square miles, especially in areas with plenty of food. They are listed as a vulnerable species and are threatened by poaching and deforestation.

Sloth Bears
(Melursus ursinus)
The sloth bear is one of the oldest living species of bears, with ancestors that can be traced back to the early Pleistocene era, approximately 1,800,000 years ago. Sloth bears inhabit forested and grassland regions of India, Bangladesh, Nepal and Bhutan and lowland forests in Sri Lanka. It’s not known for sure where the common name of “sloth” bear came from, but some believe their name derives from their slow movements. Others suggest that early explorers observed these bears hanging upside down from trees, and were mistakenly though to be related to true sloths in other parts of the world. The sloth bear has an unusually long snout or muzzle that it uses to suck up insects. While their hearing and eyesight are not very good, they have a keen sense of smell that helps them find termites, fruits, berries, insect larvae and honey.

Sun Bears
(Helarctos malayanus)
The sun bear is the smallest and rarest bear species in the world. Much like the moon bear of Tibet, its name comes from a golden yellow crescent-shaped patch of fur on its chest. It is also known as the honey bear, the dog bear and the Malay bear. This last common name comes from the fact that the sun bear is found in the rainforests of southeast Asia, including India, Bangladesh, Myanmar, Thailand, Cambodia, Vietnam, Laos, Indonesia and—of course—Malaysia. Their short, dense fur repels water and they have bare soles on their feet with long, sharp claws for climbing. These bears are roughly half the size of the American black bear, with an average adult weight between 60 to 145 pounds and measuring 48 to 60 inches in length. But don’t let their size fool you! Sun bears have excellent hearing and are considered to be very aggressive and will attack without cause. Strong jaws and sharp claws make this animal one to avoid.
American Black Bears
(Ursus americanus)
Prior to Glacier Run, the only other bear species on exhibit at the Louisville Zoo had been the American black bear—almost 20 years ago! The American black bear is the smallest and most widespread of all the bears in North America. Black bears average about 54 to 72 inches in length and range in weight between 125 to 600 pounds. Scientists have discovered that the ancestors of this bear first crossed into North America via a land bridge near the Bering Strait about 500,000 years ago. While their name implies that this bear is black, its color can range from black to brown, cinnamon to creamy white. Black bears are the least endangered species of bear and still inhabit about 85% of their historic range in Canada, as well as at least 40 of the 48 lower United States and as far south as the Sierra Madre Mountains of Mexico. Like many bears worldwide, the greatest threat to black bears is poaching.

Giant Panda Bears
(Ailuropus melanoleucus)
Giant pandas are a very ancient species, probably having first evolved between two to three million years ago, yet they remained unknown to the western world until 1869. Their scientific name means “black and white bear”—a pretty obvious description when you think about it! At one time, giant pandas could be found in most of southern and eastern China, as well as northern Myanmar and northern Vietnam. Due to increased human population in those regions over several thousand years, the giant panda’s numbers have decreased. Thanks in large part to conservation efforts over the last 20 years, it is now estimated that about 2,000 giant pandas live in the wild today. Most giant pandas are not quite so giant, when compared to a full-grown American black bear, weighing between 175 to 275 pounds. But there have been some reports of pandas reaching upwards of 350 pounds.

Andean (Spectacled) Bears
(Tremarctos ornatus)
This bear’s scientific name means “decorated bear,” referring to the light-colored rings usually found around its eyes. These markings often extend to the neck and chest, and are unique to each individual bear, just like human fingerprints. One of its more common names—Andean bear—refers to the Andes mountains where it lives, the only bear species on the South American continent! The spectacled bear is shy and elusive, hunting in the mountain forests mostly at night. Subsequently, little is known about this smaller bear species. Due to habitat loss and poaching, however, it is believed that fewer than 3,000 Andean bears live in the wild today.
Continents and Oceans of the World
(Answer Key)

American Black Bear
Andean Spectacled Bear
Sloth Bear
Asiatic Black Bear
Giant Panda Bear
Sun Bear
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you find a bear species that lives in a similar habitat? Identify the species and habitat you share</td>
<td></td>
</tr>
<tr>
<td>Can you find a bear that has a different diet? Can you explain why these differences occur?</td>
<td></td>
</tr>
<tr>
<td>Can you find a bear that shares similar physical characteristics?</td>
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</table>
Meet Qannik
The Polar Bear Cub

Summer 2011 marked the arrival of an orphaned polar bear cub found by ConocoPhillips employees up in Alaska’s North Slope in April. Qannik (say ken’ ick) means “snowflake” in the Iñupiat language and is also the name of the oil field where she was found. The cub was born in January in a snow-den her mother dug to protect her from the Arctic Alaskan winter. She was spotted in February along with her mother and sibling. In late April, she was seen again, this time alone. An unsuccessful aerial search was conducted to locate the mother. At this point it was decided by the United States Fish and Wildlife Services to rescue the cub. The Alaska Zoo took initial responsibility for her care. At the end of June, Qannik was flown from Anchorage to Louisville on a UPS plane with her own entourage of zoo directors, keepers and a veterinarian. Today she resides in the Louisville Zoo’s new, state-of-the-art Glacier Run Exhibit.

Scientists are seeing more cubs dying during their early months of life and have linked this to reduction of sea ice caused by global warming. More open water and fragmented sea ice makes it increasingly difficult for cubs to keep up with mother bears that urgently need to catch and eat seals to regain weight lost during a long winter fast.

This rescue was made possible through partnerships with USFWS, AZA’s Species Survival Plan, Polar Bears International, the Alaska Zoo, and the Louisville Zoo and UPS. Qannik has a bright future at the Louisville Zoo, serving as an ambassador for her relatives in the remnant wild and teaching us all how important it is to protect polar bears and their fragile environment.

Qannik, Busy All Day

Qannik is constantly exploring her on and off exhibit spaces. She is in a full rotational schedule with the other bears of Glacier Run.

The rotation of animals on and off exhibit is designed to enhance their health and well-being by giving them constant enrichment opportunities and more choices for interacting with their environments.

LouisvilleZoo.org
QANNIK: GENERAL INFORMATION

Range
Polar bears can be found in Northern Canada, Alaska, Greenland, Norway, and Russia.

Life Expectancy
Captive: 25 – 30 years
Wild: 20 – 30 years

Habitat
Ice covered waters of the artic region. Some move on land for the summer.

Size
One of the largest bears: males average 7 – 9 feet (may reach 9 feet) with a height of 5 feet at the shoulder. The average weight is 900 pounds and record weight is 1600 pounds. Females are smaller weighing 400 – 500 pounds on average.

Diet
The polar bear eats more meat than other bears.

Wild
Seals, fish, seabirds, decomposing whale and walrus, as well as, grass, lichens, seaweeds, moss, crowberries, bilberries, and cranberries.

Zoo
3-4 pounds of fish, 17 pounds canine diet and polar bear biscuits.

WHY POLAR & GRIZZLY BEARS?

Having these two bear species in the same exhibit helps us tell an important story about the effect of changes in our environment. Due to global climate change and the early thawing of polar ice, some polar bears are being forced to migrate inland. This means their range now crosses over with certain brown bear species. In fact, in 2007 there was a confirmed discovery of a hybrid polar bear.
How much does Qannik weigh and what does she eat?
Qannik was 572 pounds when weighed in October 2016. Her diet consists of a special carnivore ground meat mixed with lard, fish, 4 types of dog kibble, and specialty polar bear biscuits.

Do the keepers get into the exhibit with Qannik?
Her size and strength make it too dangerous for the keepers to enter the exhibit with her. Instead they interact with her through panels of steel mesh. These interactions, including training sessions, assist in developing lifelong relationships between Qannik and the Glacier Run keepers.

What does Qannik do all day?
She divides her time between the off-exhibit bedrooms and two areas viewable to guests, Bear Alley and the Glacier exhibit. The Glacier exhibit includes an 80,000 gallon pool which she uses extensively, diving, swimming, and engaging with guests through the windows.

What does Qannik play with? What are some of her favorite toys?
She has a lot of options to choose from: a burlap-covered boomer ball that acts as a seal, a log to practice her balancing skills, Frisbees, dig pits, bins of ice, and several hard plastic toys. She also loves a good session with her bin of ice. There are also blue, orange, and green balls she chases in the 80,000 gallon pool in Glacier Run. It doesn’t really matter what they toy, Qannik just loves to play and explore.

When can we see Qannik?
For the well-being of our bears, it is very important that no two days are alike, so there is no set schedule for when she might be in any of these areas. The Zoo is well-known for its ability to shift animals into different areas, known as animal rotation.

How does the Zoo help the polar bears on really hot days?
Polar bears are very adaptable to a wide range of air temperature. They can experience temperatures up to 80 degrees in their artic habitat. Unlike other bears that can hibernate during the winter, polar bears are most active during the coldest part of the year. Here at the Zoo the off-exhibit bedroom areas are air conditioned, the water in the Glacier Pool is chilled, and there is an ice machine which randomly dumps ice into the bed of the truck in the Bear Alley exhibit.
Important Questions

1. All animals need an indoor space and shelter, even if they spend most of their time outdoors. What kind of indoor space will Qannik need? How will she get in and out?

2. How will you protect Qannik from the public? And how will you protect the public from Qannik?

3. Are polar bears social or solitary? How might that affect the design of your exhibit?

4. How will the exhibit space be cleaned?

5. Can Qannik survive here in the Kentucky climate, or does it need to be an inside exhibit? Or a combination of?

6. How are you going to educate visitors about this animal? What kind of signage will you need?

7. Are there cultural elements you can include in your exhibit, items that help visitors understand more about the natural habitat of Qannik?

8. You read that one way to keep the bears stimulated is by rotating them to different parts of the exhibit several times a day, how will you keep Qannik stimulated?
UNIT 4
End of Project Writing Activity

A five-year campaign by two Michigan girls to make Girl Scout cookies more environmentally friendly has prompted the youth organization to curb the use of palm oil in its iconic baked goods. Have your students listen to an interview with these two young ladies and write a reflection.

Follow Link to watch interview:

Reflection

We have learned about animals that live all over the world. In the video two girls were able to make change for orangutans. Why do you think it’s important for kids to care about animals and the world around them?
Student Resource End of Project Writing Prompt

Animals and Their Environment

We have learned about animals that live all around the world. In the video two girls were able to make change for orangutans. Why do you think it’s important for kids to care about animals and the world around them?

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THINGS TO DO WHEN I GET BACK TO SCHOOL:

• Schedule my field study

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•
SPECIAL THANKS TO

Genentech
A Member of the Roche Group

For supporting the Louisville Zoo and helping to make “The Zoo in 3D” program and supporting materials possible.