FROM POLE TO POLE: LEARNING RESOURCE GUIDE
GRADE 4 – 6
The BBC film Planet Earth: From Pole to Pole introduces students to how the power of the sun drives our world’s climate and the life-giving cycle of water. It also explores how animals have adapted to the seasonal changes in temperature and light. From the extreme conditions faced on Antarctica by the Emperor Penguins who incubate a single egg through the four-month winter. To the forced march of the elephants in the Kalahari Desert in Africa in search of water in the rainy season.
The sun drives our planet’s changing seasons, powers the endless cycle of water, and is the source of energy for nearly every life form on our planet.

The predictable succession of the four seasons – winter, spring, summer, and fall – are a result of the Earth being tilted on its axis as it revolves around the sun. The sun’s rays strike the surface of the planet differently in each season. For example, in North America in the summer the Earth is tilted toward the sun and so the days become gradually warmer and longer. The opposite is true in the winter, when North America is tilted away from the sun resulting in shorter days and colder temperatures.

At the Arctic (North Pole) and in Antarctica (South Pole) the seasonal changes are even more dramatic. When it’s winter in the Arctic, these areas are blanketed in total darkness and endure extremely cold temperatures, but at the same time, it’s summer in Antarctica which is bathed in near constant sunlight during the summer. The reverse is also true, when it’s winter in Antarctica, it’s summer in the Arctic.
How do animals survive, find food and shelter, and care for their young through the changing seasons, especially at the polar extremes? Mother polar bears in the Arctic North spend the dark cold winter months in a snow cave. It's during this time that the mother gives birth to her cubs, usually two. The mother does not eat during this time, but uses the energy she stored up in the fall to nurse the cubs. At birth the cubs are only about 12 inches long and weigh about one pound.

In Antarctica, the Emperor Penguin survives the winter in one of the most inhospitable places on the planet where temperatures can drop to 90 degrees Fahrenheit below zero (-70 Celsius). All winter long the males huddle together to stay warm while cradling a single egg on top of their feet. The egg is kept warm by the male's warm feathers. After surviving the four-month long winter, the baby penguins hatch and as a result have a head start on other birds.

During the summer months, the poles experience just the reverse, sunlight all day. In the seas around the poles, sea ice melts and plankton thrive from the combination of near constant sunlight and nutrients in the sea water. The incredible abundance of the tiny plankton provides food to animals like fish and squid. These in turn are food for even larger predators like the fur seal, which are also hunted by the great white shark.
Not only do the interactions between the sun and oceans affect our seasons, they also have a tremendous impact on our weather patterns. In the tropics, heat from the sun warms the oceans and evaporates water into the atmosphere. The water condenses to form clouds which are carried over land. Most of the rain we experience on land started in the ocean. Hurricanes and monsoons are examples of powerful weather systems that affect the land, the animals, and people living there.

In the tropical regions, the temperature and amount of daylight stay constant through much of the year. Instead of four seasons, these areas may experience just two – typically one wet and the other the dry season. For animals living in these areas, being able to survive drought is critical until the rains come or they can find water.
The following science standards and ocean and climate principles are supported by the From Pole to Pole film, and the activities in this resource guide.

NATIONAL SCIENCE EDUCATION STANDARDS
Life Science (Standard C)
- Characteristics of organisms
- Life cycle of organisms
- Organisms and their environment

OCEAN LITERACY PRINCIPLES
1. The Earth has one big ocean with many features.
3. The ocean is a major influence on weather and climate.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.

CLIMATE LITERACY PRINCIPLES
1. Life on Earth has been shaped by, depends on, and affects climate.
3. The sun is the primary source of energy for the climate system.
4. Earth’s weather and climate systems are the result of complex interactions.
5. Earth’s weather and climate vary over time and space.
ANIMAL ADAPTATIONS

DIRECTIONS TO TEACHERS

Animals have many adaptations that help them survive where they live. In Part A of this activity, students will learn about the adaptations that help the polar bear survive where it lives. Discuss as a class how these adaptations help the polar bear survive, stay warm, move, and find food in the Arctic. How would these adaptations help it survive? Could a polar bear survive in another kind of habitat?

In part B, explain that the students will create an imaginary animal that needs to survive in a different kind of habitat, one that is hot and dry. The animal does not have to be a real animal, but the students must think about what features their animal will have that will help it in a place where it rains very little, and the temperature is hot all year long.

Make enough copies of the Student Page for your class.

After the students have completed their animal, share their results. What similarities were there between the imaginary animals and real animals you know about?
STUDENT PAGE

Part A: Polar Bear Adaptations

DIRECTIONS TO STUDENTS

The polar bear is very well adapted for life in the cold, frozen Arctic. How do these adaptations help the polar bear survive, stay warm, move, and find food? Would these adaptations help the animal to survive in another place like a desert? Why or why not?

They have a thick layer of fat, called blubber, up to 4.5 inches thick to help them stay warm.

Polar bears have two layers of fur for warmth. A dense under coat and an outer layer of longer guard hairs.

Polar bears have an incredible sense of smell – they can smell a seal from 20 miles away.

Their short tails and small ears help prevent heat loss.

They have small papillae on their feet to keep them from slipping on the ice.

Their powerful jaws and claws are for catching slippery seals.
Part B. Make an Animal

Imagine living in a very hot, dry place like a desert. How would you survive? Think about how an animal might service?

Create an animal that can survive in a hot, dry climate. The animal you create does not have to be a real animal. Think about how your animal will look. How will it be able to survive in a hot, dry climate.

For example:

- How will the animal find or store water since it does not rain very much or very often?
- How will the animal stay cool in the hot sun?
- Will the animal be active during the day or at night or just at certain times of the year?
- What special parts of your animal will help it survive?

Draw a picture of what your animal looks like in the space below. Label the parts of the animal that help it survive. Explain why those parts are important.
THE WATER CYCLE

DIRECTIONS TO TEACHERS

As the students learned in the previous activity, water is essential to life. Did you know that most of the water that falls on the land as rain, snow, etc. started in the ocean? Before starting this activity, review with your students the basic concept of the water cycle. Use the Word Wall to review the important concepts and vocabulary.

Make copies of the Water Cycle Story for each student. Working individually or in groups, ask the students to complete the story by inserting a missing word from the Word Wall into the correct place in the story.

Have students read the completed story aloud.

DIRECTIONS TO STUDENTS

Below is a simple story describing the water cycle. Some of the key words in the story are missing. Fill in the blanks with the correct key word from the Word Wall at the bottom. A word may be used more than one time.

Water Cycle Story

The ________ warms the _________. _________ from the ocean __________. The_______ _________ rises into the air. The ________ in the air gets _________ and turns back into liquid, and forms _________.

Gravity and other forces soon make the liquid fall back to Earth. This is called _________. It can take many forms: __________, __________, __________, __________, etc.

When the water falls on land it might land on a ________ or frozen on a _________. Some of the water might flow into a ________ or _________, and eventually end up back in the ________.
PRE-SHOW ACTIVITY Cont’d

Word Wall

sun               rain
ocean            snow
evaporates       hail
water            sleet
water vapor      lake
cold             mountain
condenses        river
clouds           stream
precipitation    

planet earth
4-D experience
MIGRATION GAME

DIRECTIONS TO TEACHERS

In the film From Pole to Pole students saw examples of how four animals – Emperor Penguin, polar bear, African elephant, and great white shark - are adapted to the changes in climate brought on by the change of seasons. One adaptation common to each of these animals is the ability to migrate. Migration is the annual movement of an animal from one place to another in order to find food and water, stay warm/cool, and to have and rear their young. For example, in the film you saw the migration of African elephants and other animals across the plains and deserts in order to find precious water.

In this activity, students play a simple animal migration game. The object of the game is to move their animal from the Northern (Summer) Home to the Southern (Winter) Home without running into obstacles.

Make enough copies of the Student Page for each student or group of students. Provide dice or something similar as a roll counter. Students can use any object as their token.

After the activity, review with the students the questions at the end.

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**POST-SHOW ACTIVITY**

In this activity, you will role-play an animal that migrates from the Northern (Summer) Home to the Southern (Winter) Home. Along the way, you will encounter obstacles and things that help you.

Use any object to represent your animal. Your teacher will provide dice or something similar to count the spaces. Take turns rolling the dice and moving your animal the number of spaces indicated by the dice.

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START
Northern (Summer) Home

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You have to avoid a predator
Go back 1 space
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```
You encounter bad weather
Go back 2 spaces
```

```
Trash gets in your way
Go back 1 space
```

```
People made you a protected species
Go ahead 2 spaces
```

```
You are an experienced animal and have migrated this route before
Go ahead 3 spaces
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```
Had to stop to rest
Lose a turn
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```
People picked up trash at an Earth Day event
Go ahead 2 spaces
```

```
Toxic chemicals in the environment
Go back 1 space
```

```
Had to stop to find food
Lose a turn
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FINISH
Southern (Winter) Home

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Southern (Winter) Home
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POST-SHOW ACTIVITY

DISCUSSION QUESTIONS

- Why are the animals migrating?
- Is migration easy for the animals?
- Did your animal make it? Why or why not?
- What are some risks the animals have in migrating?

ANIMAL MIGRATION

DIRECTIONS TO TEACHERS
Next, students research real animals to find out where, how and why they migrate.

DIRECTIONS TO STUDENTS
Individually or in groups list as many animals as you can that seasonally migrate from one place to another.

To get you started here are some examples of different species of animals that migrate:

Mammals: Humpback whales, elephants, caribou, bats
Birds: many species of birds such as geese, ducks, and hawks
Reptiles: Sea turtles
Insects: Monarch butterfly
Fish: Pacific salmon, Great white sharks

Pick one animal to research. Using the Internet or other sources, find out the following about the migration patterns of your animal.

1. Locate and trace your animal’s migration route on a map or globe.
2. Find out the distance traveled.
3. How they travel, (geese in a V, lobster in single file, wildebeest in herds)
4. Which animal migrates the furthest in one year? The least?
5. What hazards does the animal encounter along the way? How does it meet those challenges?
ACKNOWLEDGEMENTS & RESOURCES

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This companion piece to the film Planet Earth: Pole to Pole 4-D Experience was created by Educational Consultant Joe Harber for SimEx-Iwerks Entertainment. The following resources were used to develop this Learning Guide. Educators may reproduce these materials for students.

Design & illustration by Maggie Ziemirksa, SimEx-Iwerks Entertainment Graphic Design Department.

The Discovery Channel
Learn more about the Planet Earth Series, from which From Pole To Pole in 4D is adapted.
http://dsc.discovery.com/

Polar Bears International
Contains lots of information about polar bears and how you can help protect them.
www.polarbearsinternational.org

The Journey North
Is a global study of wildlife migration and seasonal change. Students track the coming of spring through observing the migration patterns of animals in their area. Then share their field observations with classmates across North America.
http://www.learner.org/jnorth/

U.S. Antarctica Program
Find out what’s going on in Antarctica, including webcam of the Amundsen-Scott South Pole Station.
http://www.usap.gov
Page 9: Water Cycle Story

The sun warms the ocean. Water from the ocean evaporates. The water vapor rises into the air. The vapor in the air gets cooler and turns back into liquid, and forms clouds.

Gravity and other forces soon make the liquid fall back to Earth. This is called precipitation. It can take many forms: rain, snow, hail, sleet, etc.

When the water falls on land it might land on a lake or frozen on a mountain. Some of the water might flow into a stream or river, and eventually end up back in the ocean.