



Adaptation and Habitat

IN THE FILM

earth reveals a breathtaking vision of the planet's habitats and makes it possible to truly appreciate just how extreme the contrasts are between the environments the planet's animals call home. The Polar bear mother and her cubs emerge from the crisp, white pristine snow of the Arctic into a world of ice cliffs and frozen ocean as far as the eye can see. Thousands of miles south, the Humpback whale gently supports her calf in the still and shallow sunlit waters of the tropics. The African elephant and her calf traverse a desert landscape of parched vegetation and cracking sun-baked earth as they cross the Kalahari, enveloped in billowing clouds of dust. These places on Earth's surface could not be more different, and each of them is inhabited by one of Earth's great mammals.

HABITAT FACTS...

- a habitat is an environment that provides an organism – plant or animal – with the conditions it needs to live
- all living organisms are adapted to the habitat in which they live



THE POLAR BEAR

POLAR BEAR FACTS ...

- found throughout the Arctic on ice-covered waters from Canada, to Norway, parts of the USA, Russia and Greenland
- will travel hundreds of miles in search of food
- can smell seals several kilometers away
- can swim 12 miles (20 km) a day
- Latin name “Ursus maritimus” means “sea bear”

Polar bears are perfectly adapted to the frozen Arctic world they inhabit. Their habitat experiences dramatic change during the year. As the Earth travels on its annual orbit, the polar sea ice melts in the heat of the summer sun and freezes again as polar winter comes. The sequences in **earth** show how the Polar bear is completely equipped for survival in both these states.

LIFE IN A COLD CLIMATE

On average, the temperature in the Arctic winter drops to -29°F (-34°C). If a Polar bear is to survive it has to be able to keep warm. The black tip of its nose gives a clue to one of its key adaptations. Beneath the dense yellowish white fur, a Polar bear’s skin is black. This dark color helps it absorb heat from the sun. As well as being adapted to take in heat, it is adapted to keep out cold. Below the skin a Polar bear has a layer of blubber. This layer of fat acts as an insulator, keeping its body temperature and metabolic rate the same even if the outside temperature drops to -29°F (-34°C). The bear’s fur also keeps out the cold. The wool underneath creates an insulating layer that keeps the bear warm when it’s in water. In fact, a Polar bear’s body is so effective at keeping warm that Polar bears are sprinters, not marathon runners! They can only run for short distances because over longer distances they’re in danger of overheating!

Adaptation and Habitat



HUNTING FOR FOOD

The Polar bear prefers to hunt its main food source, the Ringed seal, on the Arctic sea ice. The bears catch the seals as they emerge through holes in the ice to breed, or when they take to the ice to give birth. Polar bears are well adapted for this hunting style. Their white fur camouflages them very effectively as they lie in wait for their prey. The bear even covers its black nose with its paws to keep this out of sight! When a seal appears the Polar bear can move very quickly. It pounces on the seal using its huge clawed paws. When it eats, a Polar bear can consume a huge quantity of food. This gives it the energy to survive in such a cold climate. It gets all the liquid it needs from its food so it has no need to drink water.

HIBERNATION

Polar bears are adapted to survive a food shortage. Pregnant female Polar bears spend winter in a den. They don't go into true hibernation as they give birth during this time. They do, however, go into a state of lethargy in the den in which their heart rate slows and they sleep soundly but are easily roused. Males and other females go into "walking hibernation." The bear's metabolism alters to a hibernation-like state that conserves energy and enables it to go for days without food. This isn't something the Polar bear does only in winter. It can do it at any time of year if food supplies become scarce. By doing this, it can survive a period of hunger out on the sea ice.



WALKING ON ICE

A Polar bear spends its life patrolling an icy kingdom and its paws are particularly adapted to do this. The soles have indents. These act like suction cups to enable the bear to grip. They work in combination with the large non-retractable claws the bear has, one on each foot. Just like ice picks, these too prevent the bear from slipping.

THE SEA BEAR

During the summer months when the sea-ice melts, large tracts of the Polar bear's frozen world turns to water and it has to get around by swimming, not walking. Its big forelimbs and paws help it swim between islands and ice flows in search of fresh hunting grounds. There are numerous islands in the Arctic. The bears of **earth** were filmed on Kong Karls Land on the Svalbard archipelago north of Norway. Polar bears are strong swimmers. Using their front paws to propel themselves and their rear paws to control their direction, they can swim for long distances and have been spotted 62.14 miles (100 km) offshore from the nearest landfall.



THE AFRICAN ELEPHANT

AFRICAN ELEPHANT FACTS...

- adapted for survival in a range of habitats including desert, swamp, forest, savannah, seashore and mountain
- largest living land mammal – the largest elephant ever recorded was 12 feet (4 meters) at the shoulder and weighed 10 metric tonnes
- they may spend 12-18 hours a day feeding
- an adult elephant needs over 300 lb (140 kg) of food a day
- can consume up to 50 gallons (200 liters) of water a day
- their ears can be 6 ft (200 cm) from top to bottom
- they have a large brain
- hide is over 1 inch (3 cm) thick in places

FOOD AND WATER

An elephant needs a huge quantity of food and water to live. This is why large herds of elephants are found only in food-rich areas like the savannahs of southern Africa. In deserts, where there is little food and water available, each herd contains only a small number of elephants. Elephants often migrate between habitats to feed their enormous appetite. The elephants of the Kalahari Desert in Botswana, seen in **earth**, migrate annually to the swamps of the Okavango to find enough food and water to live. The elephant's large brain helps it to remember the location of areas where food and water are seasonally abundant. Its brain may also enable the elephant to store other information. Hence an elephant is known to “never forget!”

Adaptation and Habitat



THE MULTI-FUNCTION TRUNK

Feeding is just one function of the elephant's remarkable multipurpose adaptation: its trunk. Elephants eat all sorts of vegetation including grass, tree foliage, bark, and twigs. An elephant manipulates food and brings it to its mouth using its trunk. The trunk has numerous tiny muscles that allow the elephant to grasp branches and twigs. The elephant uses its trunk much as a human uses its hands. It has different techniques to deal with the different food types in its varied habitat: pulling up long grass with the trunk; loosening and kicking short grass into a pile with its forefeet before sweeping it up using the trunk. The African elephant can achieve very fine control with its trunk because it has two projections at the tip that act as the equivalent of two fingers. It also uses the trunk to suck up water and shoot it into its mouth to drink. An elephant doesn't drink straight from its trunk.

TUSKS

Elephants' ivory tusks are actually elongated teeth. They use them to dig out the minerals they need in their diet and to dig waterholes in dry riverbeds. These holes, excavated using the trunk, tusks, and feet, can be several feet deep. It's thought that their location is learned from social interactions.

A SOCIAL ANIMAL

Elephants are social animals. They have a number of adaptations that help them maintain communication. Their sensitive hearing allows them to keep in touch over long distances. They also use their ears as signalling devices, often to warn the herd of approaching danger. The well-developed sense of touch in their trunks is used not just for feeding, but also for social purposes.

LIFE IN A HOT CLIMATE

African elephants are adapted to survive the intense heat of the African sun. The elephant's surface area is small by comparison with its total mass. This makes it difficult to lose excess body heat. Their massive, fan-like, triangular shaped ears act as a cooling system. They are filled with blood vessels. By holding them out in the wind, or flapping them, the elephant can increase the movement of air over its ears and cool the blood running through them, thereby regulating its body temperature. They also use their trunks to cool themselves by sucking up water, or mud and dust when they're bathing (which they like to do and are seen doing enthusiastically in **earth**) and spraying it over their body. This also keeps the elephant's hide in condition. Its thick hide protects it both from attack by insects that might spread disease and from the rough ground and thorny bushes found in the elephant's habitats.

Because of their size and weight, it's not easy for an elephant to go unnoticed! Elastic, spongy cushions on the bottom of its feet help. They act as shock absorbers and help elephants move silently.



THE HUMPBACK WHALE

HUMPBACK FACTS ...

- Humpback whales are found throughout the world's oceans
- the Humpback's Latin name is "Megaptera novaeangliae"; megaptera means "huge wings"
- a Humpback's flippers are the largest of any whale, up to one-third the length of its body
- the blubber of a Humpback is the thickest of all whales
- a Humpback whale has approximately 330 pairs of baleen plates instead of teeth hanging from its jaw
- Humpback whales' very small eyes help them withstand the pressure of a deep sea dive

Adaptation and Habitat



LIFE AT THE TROPICS AND THE POLES

Humpback whales live at the surface of open oceans and in the shallow coastal waters. At different times of year they occupy two distinct and different areas of their habitat: one in the tropics and the other in the waters far south and far north towards the poles.

The tropics are their breeding grounds and they spend winter here in the warmth of the tropical seas. The shallow equatorial waters make good nurseries because they are calm and contain few predators. The polar waters are their feeding grounds. When spring comes, the Humpbacks and their calves set off: the northern hemisphere population of whales going north to the Arctic summer, the southern hemisphere whales south to the Antarctic summer.

The Humpback's enormous flippers and fluke-shaped tail power it on this journey. Beneath the whale's skin is a layer of blubber. The Humpback has the thickest blubber of all whales. It enables this warm-blooded mammal to conserve energy and heat when it's in the cold water of the poles. When the whale is wintering in warm tropical waters the layer of blubber thins out as the whale lives off it in the absence of other food.

Summer is feeding time for Humpbacks. The whales don't feed during the months they spend in their winter breeding grounds. Humpbacks are baleen whales. They have huge plates of long hair-like filaments instead of teeth. These baleen plates hang in rows from each side of the upper jaw. They are strong, flexible and made from a similar protein to the human fingernail. They filter vast quantities of water when the whale opens its mouth. Humpback whales have throat grooves that run from chin to navel. These enable the whale's throat to expand and allow large volumes of water and food into the mouth. As the mouth closes, the whale presses down with its tongue forcing all the water out through baleen plates and retaining the krill that are the whale's main food source. The polar seas are filled with billions of these tiny shrimp-like creatures. Thousands of them are filtered from each mouthful of water. During their stay in their summer habitat, the whales feed on them nonstop.



ADAPTATION AND HABITAT: ACTIVITIES

GRADES K-2: WHO LIVES WHERE YOU LIVE?

Learning objectives:

- to observe that different habitats are populated by different organisms
- to develop skills of observation and recording

Tasks

1. Talk about the featured animals in **earth**. What do children notice about where they live? What is it like where the Polar bear lives? Is it hot or cold? Are there any trees? What other animals live there? What is it like where the whale lives? What is it like where the elephant lives? Draw pictures of the animal in its habitat. Children can find inspiration for these beautiful images in the film.

2. Where did other animals in the film live? What was it like where the lynx lives? And the duck family?
3. Investigate the animals and plants in the local environment. This could be school or home-based project for an individual child or group of children. They can draw a map or plan of the locality and go on a habitat walk to observe the plant and animal life they see. They could focus on a patch of the land around their home, an area of the school grounds, or a space in the local area. They can look at sunny areas, shady areas, damp or dry areas, under stones, in bushes and trees, on open land, and in water. These are habitats of different scales, but at this age this matters less than giving children the opportunity to see that different organisms are living in different conditions. They can record on their plan, using drawings and writing, the plants and animals they see and a description of where they saw them.

Adaptation and Habitat – Activities



GRADES 3-6: ADAPTATION

Learning objectives:

- to understand that a habitat provides an animal or plant with the conditions for life
- to understand that different animals are found in different habitats
- to understand that an organism is adapted to its habitat

Tasks

1. Talk about the different habitats that are featured in **earth**. The film contains spectacular sequences that will give children a real sense of the habitats the film visits. What is the Polar bear's habitat like? What is the whale's habitat like? What is the elephant's habitat like? Make a chart of the features of each habitat including information on temperature, sunlight, water, vegetation and other animal life.
2. Talk about how the main characters featured in **earth** are adapted to their habitat. What features of the Polar bear make it so suited to its Arctic environment? Talk about the whale and the elephant. How are they adapted to their habitat? Make a chart to show how each animal is adapted, or draw the three mammals and annotate drawings to show their adaptations.
3. Talk about the three animals. Could they exchange habitats? Why not?
4. Write a fantasy story in which one of the animals featured in **earth** gets transported to the wrong habitat. What happens to it and how does it get back to where it belongs?
5. Create an imaginary animal and an imaginary habitat for it to live in. What adaptations will it have? How will these adaptations make it suited to the habitat in which it lives? The important things for an animal are to have food, water, and shelter.
6. Make a "Where do I Live?" snap game. Collect pictures of animals and stick them on a card. Create a set of matching cards on which is written a description of an animal's habitat. Two players put down cards until one sees a match between an animal and its habitat.
7. Make a study of two contrasting habitats in the local area. Visit them to take photographs and make notes on the nature of the habitat and the animals and plants living in it. These could be any habitats as long as there is a clear contrast between them. How exactly are the habitats different (water? light? soil? exposure?) Are some plants and animals living in one but not in the other? Are some living in both? Are some plants growing better in one than the other? What can children conclude about the conditions the different plants and animals need for life? Their conclusions could be presented in many ways: as a collage picture, as a computer slide presentation, or even as a video.
8. Try an adaptation experiment by growing the same plant in two different sets of conditions. Plants of the same species often grow to suit their conditions. Bluebells (*Hyacinthoides non-scripta*), for example, which are featured in **earth**'s deciduous forest sequence, grow taller in the shade than in the sun.



GRADES 7-12: HABITATS AT RISK

Learning objectives:

- to investigate the consequences of environmental change in a habitat

All forms of life, from the tiny plankton in the oceans to the elephants roaming the African savannahs, have an intricate relationship with the habitat in which they live. They are dependent on it for food, water, warmth and shelter. They are adapted to live in it, which means they face huge problems if that habitat changes. A habitat can change for any number of reasons, manmade or natural. Currently, many habitats are feeling the effects of global warming.

Global warming impacts every form of life. African elephants have used mental maps and memory over thousands of generations to find reliable water and food sources during the dry season. Global warming is predicted to effect rainfall, turning more land to desert, causing droughts and the drying up of water sources, and potentially leading elephants to migrate hundreds of miles in search of food and water that are no longer there. The survival of African elephants is already seriously threatened by changes in their habitat caused by human settlement on land they once roamed. The consequences of global warming can only make their plight worse.

Humpback whales could also face an uncertain future. Changing sea temperatures can affect oceans and potentially make any migration by the Humpback whales difficult. The whale's food supply could become unreliable if the supply of krill in the feeding grounds is reduced, or relocated. For the whale, this potential disaster lies in the future. Humpback whale populations are increasing at present. For another star of **earth** the threat is immediate.

THE VANISHING KINGDOM OF THE POLAR BEAR

The animal that is facing the most sudden and disastrous change in its habitat is the Polar bear.

THE POLAR BEAR'S WORLD

Unlike Antarctica, which is a continent in a hemisphere that is mostly water, the Arctic is mostly ocean surrounded by land. Most of the Arctic Ocean is more than 3,000 feet (1,000 meters) deep and continuously covered with ice that varies between 3 feet (one meter) and 30 feet (10 meters) thick. About one third of the Arctic Ocean is shallow. Unlike the deep ocean, this is not ice-covered year round. This sea ice is the key to life in the Arctic. It forms a platform on which animals hunt, breed, give birth and travel.

Adaptation and Habitat – Activities



This is a habitat in constant flux. Due to its high latitude, the Arctic experiences significant seasonal variation. The increase in the sun's energy in spring causes the sea ice to begin to melt. It breaks up into enormous ice floes and by summer is almost gone. In summer, when the northern hemisphere is tilted towards it, the sun remains above the horizon twenty-four hours a day. Hence the Arctic is called at this time of year "the land of the midnight sun." In winter, when the pole is tilted away from the sun, the Arctic experiences a twenty-four-hour night and the sea ice freezes again. In recent years scientific study has shown that this cycle of melting and freezing is changing.

On average, temperatures in the Arctic drop in winter to -29°F (-34°C) but recently unusually warm winter temperatures have been recorded. At the same time changes have been observed in the sea ice. It's melting earlier than it used to: in some areas up to three weeks earlier than it did 30 years ago. In addition to this, the extent of the sea ice is also decreasing.

SEA ICE FACTS ...

- between 1979 and 2003 the extent of winter sea ice fell by only 3% per decade
- in the winters of 2004 and 2005 the extent of winter sea ice fell by 6%

- summer sea ice continues to retreat at an average of 10% per decade
- one study has recorded more than a 40% loss in sea ice thickness in the past 25 years

These changes spell disaster for the Polar bear. The bear's life cycle is perfectly attuned to its Arctic world, and it is unprepared for this sudden change. Some studies have already shown a decrease in the weight of adult polar bears from an average of 650 lb (300 kg) in 1980 to 507 lb (230 kg) in 2004. In an area of Hudson Bay, the Polar bear population decreased from 1,200 to 1,000 in the ten years before 2004.

Tasks

1. Using the data on habitat change in the Arctic, in combination with the data on the Polar bear life cycle (see the Life Cycles section of the guide), investigate what the implications of changes in the Arctic are for the Polar bear. Make a chart of the Polar bear's year showing the bear's activity in each month and the Arctic climate and condition of the Arctic ice at that time. Then predict how the changes already underway will impact the Polar bear. What will happen if temperatures continue to rise and the sea ice reduces further in total area? What will happen if it continues to melt earlier and freeze later?
2. How is the bear likely to try to respond to the changes? Can any of its existing adaptations help it cope with the changes in its habitat? The Polar bear is the sea bear. What risks is it likely to take in its search for food? The adult male bear is seen in **earth** attacking walrus and swimming far offshore.