The San Diego Zoo strives to connect people to wildlife and conservation. The materials contained in this packet have all been specifically designed to prepare students for their visit to Elephant Odyssey. Everything we do is aligned to California State Science Standards. We support your classroom studies in all curriculum areas: science, language arts, social studies, and math. If you plan your own tour of the Zoo, use the free self-guided materials we provide when you make your reservation to ensure the optimal experience. It is our hope that you and your students will come away from your visit with a newfound understanding of the unique creatures that once called Southern California home and of their descendants, now found all over the world.

What Is Elephant Odyssey?
Elephant Odyssey is the most ambitious exhibit project the San Diego Zoo has ever developed. This new area showcases animals in a truly unique setting. Guests have an opportunity to see elephants in an exhibit that features a state-of-the-art care center as well as mixed-species exhibits with some unusual animals. Mammals, birds, reptiles, amphibians, and insects can all be found in Elephant Odyssey. These seemingly unrelated animals from all over the world are, in fact, connected through their ancestral history in Southern California. By looking into the past and listening to the stories that fossils and living species can tell, we hope you will learn more about the special animals that we share our planet with today.

What Is Paleontology?
Paleontology is the scientific study of ancient life forms, especially through the study of fossils. It incorporates multiple branches of science to help us learn about the origin and extinction of different types of organisms since life first appeared on Earth. Archaeology, anthropology, ecology, geology, and biology all play a role in the paleontologist’s understanding of the way the world was thousands of years ago.

What Is the Pleistocene Epoch?
The Pleistocene epoch, which occurred from 1.8 million years ago to about 10,000 years ago, was a time when large animals, or megafauna, roamed Southern California. This area was home to remarkable creatures, including saber-toothed cats, mammoths, giant sloths, and teratorns. There were also animals that existed during that time that didn’t look much different from their living cousins today—animals like snakes, pronghorn, and insects.

The climate wasn’t as different as some people imagine. While this period of time includes the last great Ice Age, Southern California was not covered in ice. The closest glaciers were in the Sierra Nevada mountain range. The weather in San Diego was cooler and more humid, though, much like the coast of Northern California is today.

In addition to all of the fossils that have been found at La Brea, Anza-Borrego, and other Southern California archaeological sites, plant fossils have been discovered as well. Seeds, cones, leaves, wood, and even pollen from various species of plants have helped to complete the picture of what Southern California looked like during the Pleistocene epoch.
While we know what Southern California looked like in terms of the flora and fauna that were here, we don’t know what caused the mass extinction of so many of these species. There are several theories as to what might have happened, and the current top theories include:

- Climate change
- Over-hunting by humans
- Meteor or comet impact that dramatically and suddenly affected the weather on Earth.

While there is no one theory that seems the most likely cause, many scientists believe that it may have been a combination of factors that caused the sudden mass extinction about 10,000 years ago.

It is important to remember, too, that not every animal species that existed during the Pleistocene epoch went extinct. Many large mammal and bird species were lost, but a few managed to survive, and numerous reptiles and insects from that time can still be found throughout Southern California and the world.

The Importance of Geography
During the Pleistocene epoch, parts of the globe were covered in ice. These giant ice sheets consumed so much of the Earth’s water that sea levels around the world dropped, most by several hundred feet. This had an impact on all living things during that time period.

One of the biggest impacts was the exposure of giant land bridges, which joined landmasses that had previously been separated by water. Land bridges that existed during the Pleistocene connected Australia and Tasmania, Southeast Asia and the Indonesian islands, North America and South America (by the Panama land bridge, which still exists but was much wider then); and Asia and North America through the present-day Alaskan islands.

This last link, known as the Bering land bridge, created opportunities for animals to migrate between North America and Asia. Animals and humans were able to move from Asia east and south into North America, and some farther south into South America, while others left North America and headed northwest into Asia. The Bering land bridge is estimated to have been about 1,000 miles wide from north to south.

Many of the large mammals that were found in Southern California during the Pleistocene are believed to have crossed over the Bering land bridge, including the mammoth, giant sloth, and saber-toothed cat. Both the horse and the camel migrated from North America to Asia. While they eventually became extinct in North America, the horses and camels that migrated across the Bering land bridge are the early ancestors of today’s living horses and camels all over the world.

Following are some of the animals exhibited in Elephant Odyssey and their Southern California extinct Pleistocene counterparts.
### Elephants

<table>
<thead>
<tr>
<th>Exhibit Animals</th>
<th>Extinct Representative</th>
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<tbody>
<tr>
<td>Southern Mammoth <em>(Mammuthus meridionalis)</em></td>
<td>Height: 9-12ft (3-4m) at the shoulders. This was the earliest and most primitive mammoth to have migrated to North America. Its tusks are not as long or curved as those of the Columbian mammoth <em>(Mammuthus columbi)</em> but more so than those of the American mastodon <em>(Mammut americanum)</em>. The most complete skeleton of the southern mammoth was recovered from the Borrego Badlands. The Anza-Borrego Desert State Park is the only place where fossils of both southern <em>(M. meridionalis)</em> and Columbian <em>(M. columbi)</em> mammoths are found together.</td>
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<tr>
<td>Columbian Mammoth <em>(Mammuthus columbi)</em></td>
<td>Height: up to 14ft (4m). This ancient elephant is a contender for the largest elephant of all time. It had the longest tusks—some measuring over 14ft (4m) long. North American in origin, it ranged throughout the southern half of the United States into Mexico. It was better adapted for grazing than previous proboscideans and had habits similar to modern elephants, living in family groups dominated by older females. It was an earlier inhabitant than the woolly mammoth <em>(Mammuthus primigenius)</em> and differed in its larger size, less curvature of the tusks, lack of a thick coat of hair, and its southerly range, although overlap did occur. Some paleontologists describe two other mammoths, the imperial <em>(Mammuthus imperator)</em> and Jefferson’s <em>(Mammuthus jeffersonii)</em> while most now consider them subspecies of the Columbian mammoth <em>(M. columbi)</em>.</td>
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<tr>
<td>Pygmy Mammoth <em>(Mammuthus exilis)</em></td>
<td>Height: 4-6ft (1.2-1.8m) at the shoulders. This was a descendant of the Columbian mammoths <em>(M. columbi)</em> that colonized the northern Channel Islands (Santa Rosa, Santa Cruz, and San Miguel) when they were all part of a single, larger offshore island known as Santarosae. Not only of American origin, this elephant was native Californian as well. The small size of these mammoths was probably the result of limited food sources and the lack of predators. Besides overall size reduction, there were other skeletal and muscular adaptations that allowed them to better maneuver the steep island slopes. Remains of over 50 individuals have been recovered, mostly from Santa Rosa.</td>
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<tr>
<td>American Mastodon <em>(Mammut americanum)</em></td>
<td>Height: 9ft (2.75m). This more primitive proboscidean differed from mammoths in its smaller size, greater number of grinding teeth, tooth formation, and smaller, straighter tusks. It was a very successful North American browser that preferred more forested habitats, especially those with conifers. It appears to have been more solitary than mammoths. Usually about the same size as southern <em>(M. meridionalis)</em> and woolly mammoths <em>(M. primigenius)</em>, the specimens from Rancho La Brea are somewhat smaller than average.</td>
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## Giant Ground Sloths

**Harlan's Ground Sloth**

*(Glossotherium harlani)*

- Height: 5.5ft (1.7m) at the shoulders and 7-8ft (2.1-2.4m) tall when standing upright.
- Weighing an estimated 3,080lbs (1400kg), this is the most commonly found ground sloth at the La Brea tar pits.
- More than 75 individuals have been recovered.
- Its short forelimbs were powerfully built and equipped with huge claws.
- It was covered with coarse, shaggy hair and had pebble-like bony plates embedded inside the skin of its back, neck, and shoulders called “dermal ossicles.”
- This adaptation is thought to be for protection from predators.
- A clumsy, slow-moving inhabitant of open country, it probably fed on grass, small shrubs, and roots that it dug up with its claws.

**Jefferson's Ground Sloth**

*(Megalonyx jeffersonii)*

- Height: 5-5.5ft (1.5-1.7m) at the shoulders and 7-8ft (2.1-2.4m) when standing upright.
- Weighing approximately 2,920lb (1,090kg), it was slightly smaller than Harlan's ground sloth (*G. harlani*).
- Jefferson's ground sloth ranged as far north as Alaska.
- It is the only ground sloth that walked on the soles rather than the outside of its feet.
- The three central claws on its hind feet were well developed and touched the ground. Presumably this allowed the animal to move more easily and with greater stability.
- Its broad, blunt caniniforms (fang-like teeth) suggest a leaf-stripping adaptation and a greater dependency on a forest habitat.
- It probably stabilized itself with its strong, broad tail while reaching up to browse on leaves.
- Thomas Jefferson's lecture on *Megalonyx* (“great claw”) to the American Philosophical Society in 1797 marked the beginning of vertebrate paleontology in North America.
### San Diego Zoo's Elephant Odyssey

Exhibit Animals and Their Southern California Extinct Pleistocene Counterparts

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<th>Exhibit Animals</th>
<th>Extinct Representative</th>
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<tr>
<td>American Bison</td>
<td>Long-horned Bison</td>
<td>Height: 7.8ft (2.4m) at the shoulder and weighed almost 2,000lbs (908kg). This is the first American bison to evolve from the original bison immigrant, the steppe bison (<em>Bison priscus</em>), which arrived from Eurasia by crossing the Bering land bridge. The largest bison from North America, its horns measured more than 8.2ft (2.5m) from tip to tip. It was adapted to wooded or forested habitats and was less social than the later plains-dwelling bison (<em>Bison bison</em>).</td>
<td><img src="image" alt="American Bison" /></td>
</tr>
<tr>
<td></td>
<td>Ancient Bison</td>
<td>Height: 6.5-7ft (2-2.1m) to the top of the hump and 10.5ft (3.2m) long. The horns were up to 3ft (.9m) from tip to tip. This species emerged from a second migration of the steppe bison (<em>Bison priscus</em>) and was adapted to wooded or savanna steppe environments. In coastal California it appears to have fed mainly by browsing on the coastal sage scrub floral community.</td>
<td><img src="image" alt="Ancient Bison" /></td>
</tr>
<tr>
<td>Dung Beetle</td>
<td><em>Copris prestinus</em> &amp; <em>Onthophagus everestae</em></td>
<td>Although well over a million invertebrates have been recovered from the asphalt deposits in La Brea, only two species are extinct: both are dung beetles, which relied on the dung of large herbivores for survival.</td>
<td><img src="image" alt="Dung Beetle" /></td>
</tr>
<tr>
<td>Camel</td>
<td>Western Camel</td>
<td>Height: 7ft (2.1m) at the shoulder. Camels and llamas originated in North America and <em>Camelops</em> is one of several species from the Pleistocene. Although it is more closely related to llamas (<em>Lama glama</em>), it resembled the modern dromedary camel (<em>Camelus dromedarius</em>) with legs about 20 percent longer and a less pronounced hump. It traveled in herds and was an opportunistic herbivore taking whatever plants were available at the time. Taxonomically, Anza-Borrego has the richest assemblage of Plio-Pleistocene camelines known anywhere.</td>
<td><img src="image" alt="Camel" /></td>
</tr>
<tr>
<td>Domestic Horse</td>
<td>Western Horse</td>
<td>Height: 4ft 10in (1.47m) at the shoulders. North America is the birthplace of horses. At one time, horses were the most abundant hoofed mammals in North America. They spread throughout most of the world before becoming extinct in both North and South America. <em>Equus occidentalis</em> had a strong resemblance to the modern plains zebra (<em>E. burchelli</em>) and the extinct South African quagga (<em>E. quagga</em>). It may even have had stripes. It is the most abundant horse found in the La Brea tar pits and was quite common throughout Southern California.</td>
<td><img src="image" alt="Domestic Horse" /></td>
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<tr>
<td></td>
<td>Mexican Horse</td>
<td>This small stout-limbed horse was 3ft 11in–4ft 6in (1.2-1.4m) tall and was the most common small horse in much of North America during the Pleistocene epoch. It appears to have preferred more lush, open country, however in Southern California, it was more common in the high desert regions than the coast and inland valleys.</td>
<td><img src="image" alt="Mexican Horse" /></td>
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<tr>
<td>Large-headed Llama</td>
<td><em>Hemiuiauchenia macrophala</em></td>
<td>Height: up to 6.6ft (2m) at the shoulders. <em>Hemiuiauchenia</em> was distributed from coast to coast across the lower parts of North America. This species is probably ancestral to all other llamas. It preferred open grasslands and was an opportunistic herbivore. Some paleontologists hypothesize that like the African gerenuk (<em>Litocranius walleri</em>), it could stand upright on its hind legs, allowing it to reach the most succulent leaves. The camelines (camels and llamas) originated in North America and then spread to South America, Asia, and Africa as far south as Malawi.</td>
<td>![Image]</td>
</tr>
<tr>
<td>Tapir</td>
<td><em>Tapirus californicus</em></td>
<td>Tapirs are relatively primitive browsers that originated in North America. Two species of tapirs inhabited the southwest U.S. during the Pleistocene, differing mainly in size. The larger is called <em>Tapirus merriami</em> and the smaller is called <em>T. californicus</em>. The smaller species measured up to 47in (120cm) at the shoulder and weighed between 500 and 660lbs, and closely resembled the living Baird's tapir (<em>T. terrestris</em>) in size and shape. Because there is little difference between Pleistocene North American tapirs and their extant cousins, they are good examples of &quot;living fossils.&quot;</td>
<td>![Image]</td>
</tr>
<tr>
<td>Capybara</td>
<td><em>Neochoerus pinckneyi</em></td>
<td>About 40 percent larger than living capybaras (<em>Hydrochaeris hydrochaeris</em>), this species was up to 32in (82cm) at the shoulders, 70in (178cm) long, and weighed up to 155lbs (70kg). Their teeth were also 30 percent larger than those of extant species. The first one known from western North America was found near Oceanside.</td>
<td>![Image]</td>
</tr>
<tr>
<td>Pronghorn</td>
<td><em>Antilocapra americana</em></td>
<td>Pleistocene and modern pronghorn (<em>Antilocapra americana</em>) are virtually indistinguishable. It is the fastest mammal in the Western Hemisphere with the ability to maintain speeds of 35 to 45mph (56 to 72kph). This ability is thought to have evolved in response to the extinct American cheetah (<em>Miracinonyx</em>) since there are no living predators that can match the pronghorn in speed.</td>
<td>![Image]</td>
</tr>
<tr>
<td>Dwarf Pronghorn</td>
<td><em>Capromeryx minor</em></td>
<td>Less than 2ft (56cm) tall and weighing about 22lbs (10kg), the dwarf pronghorn (<em>Capromeryx minor</em>) was one of the smallest ruminant herbivores found at Rancho La Brea. It was superficially similar to modern pronghorn (<em>Antilocapra americana</em>) but was smaller and had horns with two distinct prongs instead of one. It may have been similar in habits to the current African dik-diks (<em>Madoqua</em>), inhabiting areas of thick brush and tall grass where it could forage and remain hidden.</td>
<td>![Image]</td>
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</tbody>
</table>
**American Lion**
*Panthera alrox*

These were the largest lions ever to have existed, weighing up to an estimated half ton. They averaged 4.9ft (1.5m) high at the shoulders and 11.5ft (3.5m) in body length. Males were nearly 25 percent larger than today's male African lions (*Panthera leo*). They were among the largest flesh-eating land animals that lived during the Ice Age. Males were larger than females and probably had a smaller mane size compared to the extant African lion. Also unlike African lions, it appears to have hunted in pairs or alone.

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**African Lion**

- Height: 3.3ft (1m) at the shoulders.
- Length: 6.5ft (2m) from rump to snout.
- Weight: 350-620lbs (160-280kg).

This is one of several species of cats during this time with massive canines. Its jaw opened very wide, allowing use of its 7-inch teeth to sever the arteries and windpipe of its prey. It was an active predator that relied on stealth and ambush rather than speed. There is evidence that this cat was social, living in groups or prides. The *Smilodon* is the state fossil of California.

---

**Saber-toothed Cat**
*Smilodon fatalis*

Height: 3.3ft (1m) at the shoulders. Length: 6.5ft (2m) from rump to snout. Weight: 350-620lbs (160-280kg). This is one of several species of cats during this time with massive canines. Its jaw opened very wide, allowing use of its 7-inch teeth to sever the arteries and windpipe of its prey. It was an active predator that relied on stealth and ambush rather than speed. There is evidence that this cat was social, living in groups or prides. The *Smilodon* is the state fossil of California.

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**Jaguar**
*Panthera onca augusta*

The Pleistocene jaguar (*Panthera onca augusta*) was 15 to 20 percent larger than the living species. Modern jaguars (*P.onca*) are smaller in size and have reduced limb length compared to the Pleistocene species, suggesting adaptation from more open habitats to forests. Jaguar fossils are fairly rare in Southern California. However, this is not surprising. It appears that the American lion and jaguar may have been mutually exclusive. Where the American lion (*Panthera alrox*) was more common, the jaguar was rare, and where the jaguar was common—Texas, Tennessee, and Florida—the American lion was rare.
### San Diego Zoo's Elephant Odyssey
#### Exhibit Animals and Their Southern California Extinct Pleistocene Counterparts

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<tr>
<td>Secretary Bird</td>
<td>Daggett’s Eagle (Buteogallus daggetti)</td>
<td>This eagle superficially resembled the African secretary bird (Sagittarius serpentarius). It had legs almost as long as those of the great blue heron (Ardea herodias) suggesting very different ground habits for an eagle. Fossil evidence suggests it may have had a preference for forested habitat, where it most likely relied on small vertebrates for food. However, there is some indication that it may have also been a scavenger.</td>
<td><img src="image1.png" alt="Secretary Bird" /></td>
</tr>
<tr>
<td>California Condor</td>
<td>Extinct California Condor (Gymnogyps amplus)</td>
<td>Condors appear to be American in origin and the sole North American survivor of the Pleistocene avian megafauna. Gymnogyps amplus is only slightly larger than the living California condor (G. californicus). There is debate whether G. californicus and G. amplus are distinct species. G. amplus could be considered a paleosubspecies, which is a prehistoric (usually Late Pleistocene) subspecies of living taxa that changed to adapt to the climatic changes during the last Ice Age. Although change is usually in size, it can also include other physical, morphological, genetic, and/or behavioral changes over time on an evolutionary scale. When this happens, the parent species and the newly evolved species could not be classified as the same species if they existed at the same time. However, throughout the evolutionary change, there is only one species living at any point in time, as opposed to one species branching off into many through divergent evolution.</td>
<td><img src="image2.png" alt="California Condor" /></td>
</tr>
<tr>
<td></td>
<td>Merriam’s Teratorn (Teratornis merriami)</td>
<td><em>Teratornis</em> is Greek for “monster bird.” Merriam’s teratorn (Teratornis merriami) was the largest bird recovered from the asphalt deposits at Rancho La Brea. It stood over 2.5ft (.76m) tall, weighed over 30lbs (14kg), and had a wingspan of 10-12ft (3-3.7m). Originally thought to be a scavenger, it has now been determined to have been more of an active hunter. Its heavy body, short legs, and jaw structure indicate that this bird would have captured its prey by stalking and then swallowed it whole. Additionally, unlike vultures, it was probably light colored with a fully feathered head.</td>
<td><img src="image3.png" alt="Merriam’s Teratorn" /></td>
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</tbody>
</table>
objective: Students will distinguish between modern-day animals and animals that were alive during the last Ice Age.

Introduction
During the last Ice Age there were many large animals, or megafauna, roaming the Earth. Most of these amazing species are now extinct. Many of these animals, however, have relatives that are alive today whose body structures have similar characteristics. Some, however, look much different than their Ice Age counterparts.

Activity
Copy and pass out the worksheet entitled Compare and Contrast. Looking at the illustrations, have your students discuss: How are they alike? How are they different? Have students circle the animals that lived during the Ice Age and color the animals that can be seen at the San Diego Zoo’s Elephant Odyssey exhibit.

Elephants vs. Mammoths
- Elephants are large mammals that have thick, wrinkly, gray skin, huge feet, big ears, tusks, and a long nose called a trunk.
- Columbian mammoths were even bigger than elephants (as tall as a double-decked bus!). They had longer tusks that were curved at the end.

Two-Toed Sloths vs. Ground Sloths
- Two-toed sloths are medium-sized, slow-moving mammals that spend most of their time hanging upside down, holding onto branches with their long, sharp claws.
- Some Ice Age ground sloths were as big as elephants! They did not live in trees but walked on the ground. Most of them could stand up on their hind legs, using their large tail to balance.

Guanacos vs. Large-headed Llamas
- Guanacos are four-legged mammals with a long neck, small head, and pointed ears. They look a lot like llamas with woolly reddish-brown hair on their back and lighter hair on their belly.
- Large-headed llamas used to roam California. These llamas were over six feet tall (taller than most people) and could stand upright on their hind legs to reach leaves in the tops of the trees.

Jaguars vs. Saber-toothed Cats
- Jaguars are big cats with a thick, long tail. They have strong jaws that they use to crush food. Jaguars can be black or spotted and weigh about the same as a person (100 pounds or more).
- Saber-toothed cats were massive cats of the Ice Age. They weighed as much as 600 pounds and had very long canine teeth.

California Condors vs. Merriam’s Teratorns
- California condors are large birds with black feathers and a bald, pink head. They are one of the biggest flying birds in the world. As scavengers, they eat the leftovers of other animals’ hunts.
- Merriam’s teratorns were “monster birds” of the Ice Age. They were active hunters, with a heavy body and short legs. They probably had light-colored feathers and feathers on their head.
Circle the animals that lived during the Ice Age.

Color the animals that can be seen at the San Diego Zoo’s Elephant Odyssey exhibit.
**objective:** Students will understand that different habitats were available during the Ice Age and these supported different forms of life.

**Introduction**

Even though it’s known as the last great Ice Age, California was not covered in ice. But because so much water was trapped in the ice in other parts of the world, the sea level was several hundred feet lower than it is today. The landscape was dominated by large animals, or megafauna. Humans were also around during this time period. Ask the students what it might have been like to be alive during the Ice Age. How was the habitat different? What kinds of plants and animals would you see that are not here today?

**Activity**

Copy and pass out the pages entitled Southern California During the Ice Age and Ice Age Animals. As the students are coloring the habitat, read the passage below. Ask the students to color and cut out the Ice Age animals and glue them into their habitat.

Ten thousand years ago, California was a bit different than it is today. The weather was cooler, but not cold. The air had more moisture. Because it was the Ice Age, there were huge ice blocks called glaciers at the top and bottom of the Earth. But California was not covered with ice. Instead, it was covered with forests. There were huge pine trees that towered towards the sky. There was not as much desert or dry, flat land. Instead, there were hundreds of streams, rivers, and ponds.

There were huge mammals at that time, such as the Columbian mammoth. Bigger than the biggest elephant you’ve ever seen, Columbian mammoths ate grass and thundered around toting huge tusks that were as long as a limousine. Saber-toothed cats, which had the biggest, sharpest front teeth (canines), caught prey like camels, antelope, and horses. Because the cat’s front teeth were so big, it probably had to eat its food through the sides of its mouth. Jefferson’s giant ground sloth was as tall as a school bus! They did not live in trees but walked around on the ground. They ate from the Osage orange tree, standing upright on their hind legs and large tail to reach the tops of the trees.

There were huge “monster birds” called Merriam’s teratorns that soared overhead, displaying an amazing 12-foot wingspan. There were Daggett’s eagles that walked around on long legs, looking a lot like today’s secretary birds. Enormous long-horned bison (taller than people and with horns over eight feet long) wandered through the forests. Pronghorn raced across the grasslands. There were even American lions—the largest lions that ever lived!
Changing Habitats: Ice Age California

Southern California During the Ice Age
Ice Age Animals
objective: Students will investigate the life cycle of an extinct Ice Age insect by examining the life cycle of a modern-day relative.

Introduction
Over one million types of invertebrates (animals without backbones, such as worms, mollusks, and insects) were here in California during the Ice Age. Most of these, including grasshoppers, termites, flies, scorpions, pill bugs, and water fleas, are still alive today. An example of an invertebrate that went extinct was a dung beetle. We can guess what the life cycle was of those ancient insects by looking at African dung beetles that are alive today.

Dung beetles have amazing life cycles. Can you believe that these insects actually hatch in a ball of poop produced by plant eaters such as elephants? In fact, dung is another name for “poop!” Dung beetles eat poop too. Babies will eat the solid part of the poop while adults like to suck up the juices.

This is the life cycle of the dung beetle. First, the beetle scoops up a ball of dung with its front legs and rolls it into a burrow underneath a dung pad or pile. The beetle then lays an egg inside the dung ball. The egg hatches into a larva, and that eats the dung around it to grow. Next the larva becomes a pupa, like a caterpillar in a chrysalis, so it can undergo metamorphosis and turn into a beetle! It then breaks out of the dung ball and digs out of the burrow. The new dung beetle flies away and finds a new, fresh pad of poop so it can scoop up its own dung balls!

Activity
Life Cycle Wheel

Supplies:
white paper plates
brass brads
copies of sentence boxes and pictures
scissors
markers, crayons, or colored pencils

glue

Make copies of the page entitled The Dung Beetle Life Cycle and have your students do the following:

Step 1: Use the template to mark a triangle on plate #1. Cut out the triangle (but don’t cut all the way to the center point). Leave room for the bracket. Title, color, and decorate.
Step 2: Cut out the Life Cycle Wheel, color, and decorate.
Step 3: Glue the Life Cycle Wheel on Plate #2.
Step 4: Place plate #1 on top of plate #2 and fasten with a brass brad through the center.
Step 5: Turn the top plate to tell the story of a dung beetle’s life cycle.

Why do you think two different kinds of dung beetles went extinct during the Ice Age but other insects did not?
Dung Deal: Life Cycles of the Ice Age

The Life Cycle Wheel

Stage 1: The beetle scoops up a ball of dung and rolls it to the burrow.

Stage 2: The female lays an egg inside the ball of dung.

Stage 3: The egg hatches into a larva. The larva eats the dung to grow.

Stage 4: The pupa undergoes metamorphosis to become a beetle.

Stage 5: The new beetle exits its dung ball and climbs to the surface.

Dung balls are buried underground.
Dung Deal: Life Cycles of the Ice Age

The Life Cycle Wheel

Template for Life Cycle Wheel
Plate #1
objective: Students will learn the body features of the Columbian mammoth and African elephant.

Introduction
Elephants are large plant-eating mammals found in grassland habitats of Africa and Asia. Ask your students to name the adaptations elephants have for survival and list them on the board. Discuss how these adaptations help elephants. Are African and Asian elephant adaptations different? How?

<table>
<thead>
<tr>
<th>Elephant</th>
<th>Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large legs and feet</td>
<td>To support body weight</td>
</tr>
<tr>
<td>Long trunk</td>
<td>For pushing over trees, picking things up, and holding water</td>
</tr>
<tr>
<td>Tusks (long front teeth)</td>
<td>For lifting things, digging up water, and defense</td>
</tr>
<tr>
<td>Large ears</td>
<td>For cooling off on a hot day</td>
</tr>
</tbody>
</table>

Huge animals known as mammoths lived here in California during the Ice Age. Understanding the adaptations of modern-day elephants helps us to understand mammoth adaptations. The Columbian mammoth was larger than any elephant that has ever lived! Like modern elephants, it had large legs and feet and a long trunk. But it also had smaller ears when compared to its body size. The Columbian mammoth also had much larger tusks. They could be up to 14 feet long. That’s as long as a limousine!

Activity
Make copies of the pages entitled Build An Elephant. Have students cut out the body puzzle parts. Ask them to glue the body puzzle parts of the Columbian mammoth and the Asian elephant onto separate pieces of paper. Have the students review the body parts of Asian elephants and the Columbian mammoths. How are they alike? How are they different? How are they adapted for living in forest and grassland habitats? Have the students draw habitats around the mammoth and the elephant.

The Big Time: Mammoth Adaptations

Correlates with the Science Content Standards:
Adaptations
The Big Time: Mammoth Adaptations

Build an Elephant

Columbian Mammoth

Asian Elephant
**objective:** Students will learn what a food chain and food web are. They will also learn the flow of energy within a food web and who eats whom in a food chain.

**Introduction**
Back in the Pleistocene epoch, there were many different types of animals: meat eaters (carnivores), plant eaters (herbivores), scavengers, decomposers, and many different types of plants (producers).

Producers are plants that can make their own food, like an Osage orange or cycad. Primary consumers (herbivores) like capybaras and pronghorn ate only plants, while secondary and tertiary consumers (carnivores), like saber-toothed cats, Daggetts’s eagles, and American lions, ate the herbivores. Decomposers and scavengers (like dung beetles, worms, and Merriam’s teratorns) helped to clean up dead carcasses and decomposing material.

Almost everything you eat can be traced back through food chains to the sun. A food chain consists of a series of organisms in which the first organism is eaten by a second and the second is eaten by a third. During this process, nutrients and energy from the organism are transferred to the individual that eats it. This transfer of nutrients and energy decreases through the food chain. It begins with the highest level of energy (the sun) and that energy is transferred into the plants, which then gets transferred at a lower level to the herbivores, and then onto the carnivores, and so on.

**Supplies:**
- scissors
- tape or glue
- page of “chain links” (one per student)
- pipe cleaners

**Activity**
1. **Step 1:** Give an introduction on the vocabulary and subject matter to your students.
2. **Step 2:** Photocopy and pass out one page of Chain Links for each student, along with scissors.
3. **Step 3:** Tell students to cut out all the “links” on their paper.
4. **Step 4:** Have students make their “links” into circles using tape or glue.
5. **Step 5:** Explain to students how energy flows within a food chain. Have the students put their links in order from the sun to the producer to the primary consumer to the secondary consumer.
6. **Step 6:** Have the students use the pipe cleaners to connect their circle links together in order. The pipe cleaners represent the energy flow within the food chain.
7. **Step 7:** Students should then repeat this process to form at least one more chain using the rest of the “links” from their paper.
8. **Step 8:** To form a web, students will take one pipe cleaner and loop it through one of the chains and then connect it to another chain. Repeat this process until all the chains are connected into the web.
9. **Step 9:** After visiting the Elephant Odyssey exhibit at the San Diego Zoo, have the students create their own food web using the modern-day plants and animals found within the Elephant Odyssey exhibit.

**Correlates with the Science Content Standards:**
- Food Chains and Food Webs

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**i wonder...**
What would happen to your food chain if one of the links became extinct?

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The Links of the Food Chain

Chain Links

- Worm
- Pronghorn
- Daggett's Eagle
- Dung Beetle
- Capybara
- Sun
The Links of the Food Chain

**Chain Links**

- **American Lion**
- **Merriam's Teratorn**
- **Osage Orange Tree**
- **Cycad**
- **Saber-toothed Cat**
- **Sun**
**objective:** Students will investigate what a fossil is and learn how to make their own fossil from glue.

**Introduction**
Fossils are ancient plant, animal, and microbe life that lived in the past and have been preserved in stone, ice, or sap. When animals or plants decompose beneath the soil, the space where they lay can be filled with minerals from groundwater. The glue that you will use is like these minerals. Many fossil remains from the late Pleistocene epoch have been found in Southern California, such as mammoths, saber-toothed cats, giant sloths, dire wolves, and many other animals. You can make your own fossil and then compare and contrast your fossil to real fossils found in the Elephant Odyssey exhibit at the San Diego Zoo.

**Supplies:**
- modeling clay
- white glue
- any type of hard item like a shell, stick, bone, rock, or pieces of plastic animals

**Activity**
1. **Step 1:** Have students investigate what a fossil is and what some fossils of the late Pleistocene epoch looked like.
2. **Step 2:** Have students collect items they would like to use to make their own fossil, like shells, sticks, bones, rocks, or even pieces of plastic animals.
3. **Step 3:** Give each student a small ball of modeling clay and have them flatten it out like a pancake.
4. **Step 4:** Then have students press their object into the clay so that it makes an impression of their object. Then have them slowly remove their object from the clay. The object should make a mold into the clay.
5. **Step 5:** Have students take white glue and fill in their impression. It may take several days for the glue to dry thoroughly.
6. **Step 6:** Once the glue has dried, peel back the glue shape from the clay. The glue shape is now the “fossil” of the object. You can have students experiment with different shapes to see how fossils are made. Have students study each other’s fossils to guess what they are.
7. **Step 7:** Go visit the Elephant Odyssey exhibit at the San Diego Zoo. Explore the Fossil Portal and have students investigate similarities and differences between the fossil they made and real fossils in the exhibit.

**What do you think scientists can learn about an animal by studying fossils?**

**Correlates with the Science Content Standards:**
*Investigation and Experimentation*
To create a fossil, (1) take items like the shells above, (2) make impressions in clay, and (3) fill those impressions with white glue. When the glue dries, you will have your own fossils!
objective: Students will learn where many modern-day animals live in the world today, along with the name of the continents.

Introduction
During the late Pleistocene epoch (10,000 to 14,000 years ago), sea levels were lower than they are today due to many parts of the globe being covered in ice. These low levels exposed giant land bridges, which joined landmasses that had previously been covered by water. This joining of land created an opportunity for many animals to migrate from one continent to another. Many of the larger land mammals that were found in Southern California during the Pleistocene time period migrated to other parts of the world, such as South America and Asia. Although many of the animals in Southern California became extinct, their descendants survived in other parts of the world and continued to evolve into what we know now as modern-day animals, such as elephants, jaguars, sloths, camels, tapirs, capybaras, and guanacos.

Supplies:
scissors
glue sticks
one world map (one per student)
page of modern-day animal cutouts (one per student)

Activity
Step 1: Before the activity begins, enlarge the map (or use one you may have in your classroom) and enlarge the sheet of animal cutouts.
Step 2: Hand out the world map and animal cutouts to each student, along with a pair of scissors.
Step 3: Have students label the 7 continents of the world and the 4 major oceans.
Step 4: Have the students cut out all the animal shapes and begin placing the cutouts where they think the animals are found.
Step 5: When the students have finished placing their animals on their own map, begin asking for volunteers to come up and place the enlarged animals on the enlarged map in the front of the classroom.
Step 6: Once all the animals are placed on the map, ask students to check their own map for accuracy, move any animals that are on the wrong continents, and then glue their animals onto the map.
Present-Day Animals

Camel

Elephant

Llama

Capybara

Tapir

Leopard
objective: Students will learn what a carbon footprint is and how their behaviors can reduce their own footprint, thus helping animals and their habitats around the world.

Introduction
Unfortunately, many animal populations are declining. The reasons for these reductions in numbers include, but are not limited to, habitat loss, introduced species, pollution, and climate change. Climate change is one of the greatest factors affecting animals around the globe today. It is caused by elevated carbon dioxide emissions, especially humans’ increased use of electricity, oil, and gas. When the carbon dioxide gets too high, temperatures become warmer, affecting animals and plants. One theory about why animals that lived in the late Pleistocene epoch went extinct is that climate change altered their environment. By examining and pledging to change your own carbon footprint, you can help save today’s animal populations from declining.

Activity
Step 1: Have your students visit the Web site: www.zerofootprintkids.com to calculate their carbon footprint and record their numbers on a class chart.
Step 2: Have your class take a pledge to reduce their carbon dioxide emissions.
Step 3: Pick 2-3 items from the list below to do in your class and/or at home during the next month.

Ways to Reduce Your Carbon Footprint
1. Ride your bike or walk to school, instead of getting a ride or driving.
2. Purchase a reusable water bottle to drink from, instead of using a new plastic bottle.
3. Turn off the lights every time you leave the room.
4. Keep your thermostat at 68 degrees in the winter and 78 degrees in the summer.
5. Eat at least one less meal with meat in it each week.
6. Purchase items that are made from recycled material.
7. Unplug your cell phone charger and game systems when not in use.
8. Use both sides of paper and then recycle it when you are finished.
9. Recycle products such as cans, bottles, paper, cell phones, ink cartridges, and batteries.
10. Make your own compost for the yard and put all appropriate food scraps in it.

Step 4: Keep a chart of what your students are doing during the month at school. Have students keep individual charts of what they are doing at home (see sample on next page).
Step 5: At the end of the month, have students recalculate their carbon footprint on the computer and record their numbers on the class chart.
Step 6: Have students share their individual charts and discuss. Did your carbon footprint change over the course of the month? How did it change? What actions did you do to help it change? What else could you do to further reduce your carbon footprint?
Step 7: Once your students have addressed their carbon footprint, challenge them to reduce their water use.
Your Carbon Footprint

Chart Your Progress to Reduce Your Carbon Footprint

<table>
<thead>
<tr>
<th>Resource: Electricity</th>
<th>Resource: Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilowatt/hour</td>
<td>HCF*</td>
</tr>
<tr>
<td>January</td>
<td>January</td>
</tr>
<tr>
<td>750</td>
<td>14</td>
</tr>
<tr>
<td>February</td>
<td>February</td>
</tr>
<tr>
<td>550</td>
<td>13</td>
</tr>
<tr>
<td>Net Savings</td>
<td>Net Savings</td>
</tr>
<tr>
<td>200</td>
<td>1</td>
</tr>
<tr>
<td>kilowatt/hour</td>
<td>kilowatt/hour</td>
</tr>
<tr>
<td>cost</td>
<td>January</td>
</tr>
<tr>
<td>$75.28</td>
<td>14</td>
</tr>
<tr>
<td>cost</td>
<td>February</td>
</tr>
<tr>
<td>$55.65</td>
<td>13</td>
</tr>
<tr>
<td>HCF*</td>
<td>Net Savings</td>
</tr>
<tr>
<td>cost</td>
<td>$19.63</td>
</tr>
<tr>
<td>kilowatt/hour</td>
<td>change from</td>
</tr>
<tr>
<td>change from</td>
<td>previous month</td>
</tr>
<tr>
<td>previous month</td>
<td>January</td>
</tr>
<tr>
<td>750</td>
<td>kilowatt/hour</td>
</tr>
<tr>
<td>cost</td>
<td>January</td>
</tr>
<tr>
<td>$75.28</td>
<td>14</td>
</tr>
<tr>
<td>kilowatt/hour</td>
<td>change from</td>
</tr>
<tr>
<td>change from</td>
<td>previous month</td>
</tr>
<tr>
<td>previous month</td>
<td>February</td>
</tr>
<tr>
<td>550</td>
<td>13</td>
</tr>
<tr>
<td>kilowatt/hour</td>
<td>cost</td>
</tr>
<tr>
<td>$55.65</td>
<td>$39.13</td>
</tr>
<tr>
<td>change from</td>
<td>change from</td>
</tr>
<tr>
<td>previous month</td>
<td>previous month</td>
</tr>
<tr>
<td>200</td>
<td>January</td>
</tr>
<tr>
<td>$19.63</td>
<td>$2.79</td>
</tr>
</tbody>
</table>

*HCF is a hundred cubic feet of water or 748.05 gallons.
Objective: Students will learn to write a blog about an animal they learned about at the San Diego Zoo’s Elephant Odyssey exhibit.

Introduction
What is a blog? A blog (short for Web log) is an online journal. It can be about anything you want and is usually set up chronologically, with the most recent entry found at the top of the blog page. People can read your blog, make comments about the content and link them to your site, or e-mail their thoughts to you. You can read their comments and keep them so others can read them, or you can delete them. All types of people write blogs, from journalists and politicians to scientists and students like you!

Supplies:
computer and Internet access

Activity
Step 1: Describe a blog to your students. Visit the San Diego Zoo’s Web site, www.sandiegozoo.org, and check out the blog section (under the Animals & Plants or Education headers). Keepers, educators, curators, researchers, and other San Diego Zoo employees write these blogs.
Step 2: Visit the San Diego Zoo’s Elephant Odyssey exhibit.
Step 3: Discuss the students’ observations and research, and ask the students the following questions: What species did you observe? Does it have a counterpart from the Pleistocene epoch? Did it survive the mass extinction? Where is the animal found now? Where was it (or its counterpart) found during the Pleistocene? What is its habitat like? What behaviors did you observe? What surprised you? What did you learn?
Step 4: Ask students to write their blogs.
Step 5: Open a free blog account (try www.blogger.com or www.livejournal.com) for your class. It takes a few minutes to sign up and then you can post your students’ blogs.
Step 6: Share your blog information with your students’ parents and ask them to go online and comment on the blogs’ content.

We live in an age where information sharing can be almost instantaneous. How do you think having worldwide access to facts and opinions is good for science?

i wonder...
Elephant Odyssey is Awesome!

My class visited the new Elephant Odyssey exhibit at the San Diego Zoo. When we walked through the fossil portal we could stand next to life-size statues of Columbian mammoths, a giant ground sloth, a saber-toothed cat, an American lion, and a Daggett’s eagle—many of the animals that we studied in class. We saw their modern relatives such as Asian elephants, tree sloths, jaguars, African lions, and secretary birds. The elephant exhibit was really large and included a large pool and some odd-looking trees that I learned were called “utlilitrees.” Unlike the fake trees that elephants can knock over, these take trees provide shade and a place where keepers can hang food. One keeper brought out a camel for my class to meet. I was picked to touch the camel and tell my class what it felt like. The camel’s shaggy coat felt sort of soft and coarse. I learned that California condors lived during the Pleistocene and scavenged on the carcasses of mammoths. Even with the disappearance of mammoths this bird was able to survive. It’s only now with the help they have been able to recover. In upcoming blogs I will tell you more about the animals that I saw in Elephant Odyssey and share what I learned back in class.

Elephants lived in Southern California?

To prepare for our school visit to the San Diego Zoo’s Elephant Odyssey exhibit, we have been learning about animals that lived in the Pleistocene. Can you believe that mammoths lived in Southern California over 12,000 years ago? They weren’t the only radical animals that lived at that time. There were saber-toothed cats, American lions, and giant ground sloths that stood 8 feet tall. There was a bird called Merriam’s teratorn whose wingspan was 12 feet wide. Scientists have studied their bones and have theories about how these animals lived and died. About 10,000 years ago, mass extinctions took place in North
**objective:** Students will learn the debate process through debating a topic relevant to animal care or conservation.

**Introduction**
The process of making decisions is rarely simple. There are often hotly debated issues that must be considered by teams of people before policy can be established. Nowhere is that more true than in the animal care and conservation arena.

**Step 1:** Describe the debate process to your students. Explain that they will be working in teams, taking sides, and arguing the pros and cons of some of today’s most controversial issues.

**Step 2:** Provide students with topic information and allow them time to research their side and prepare for the debate.

**Step 3:** Debate!

**Possible topics include:**
- Elephants should be able to live at zoos.
- Elephants live longer in zoos than in the wild.
- Mammoths should be brought back from extinction using cloning techniques.
- Only animals that have gone extinct due directly to human actions should be cloned.
- Climate change is a fact / myth.
- Money and effort should be focused on conserving animals in their natural habitats, not in zoos.
- California condors are not worth conserving.
- Human needs are more important than animal needs.

**Argument isn’t necessarily a bad thing. Since the beginning of time, people have had different perspectives on different situations. How do you think sharing opinions is beneficial to understanding?**
**Objective:** Students will use multiplication skills and practice collecting data and drawing conclusions.

**Introduction**
Heart rate is an indicator of health. Some animals have low heart rates because they have slow metabolisms. Others have much higher heart rates because they need to keep their bodies warm regardless of the outside temperature. Typically, the larger an animal is, the slower its heart pumps, but that is not always the case. Below are the heart rates or beats per minute (bpm) of some of the animals in Elephant Odyssey:

<table>
<thead>
<tr>
<th>Animal</th>
<th>Heart Rate (bpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian elephant</td>
<td>30</td>
</tr>
<tr>
<td>Domestic camel</td>
<td>40</td>
</tr>
<tr>
<td>Domestic horse</td>
<td>40</td>
</tr>
<tr>
<td>African lion</td>
<td>55</td>
</tr>
<tr>
<td>Guanaco</td>
<td>110</td>
</tr>
<tr>
<td>Red diamond rattlesnake</td>
<td>40</td>
</tr>
<tr>
<td>Black-tailed brush lizard</td>
<td>110</td>
</tr>
<tr>
<td>Humans</td>
<td>60-110</td>
</tr>
<tr>
<td>Two-toed sloth</td>
<td>50</td>
</tr>
</tbody>
</table>

**Supplies:**
- stopwatch or clock with a second hand
- pens or pencils
- worksheet entitled, “The Beat Goes On!”

**Activity**

**Step 1:** Distribute a worksheet to each student. Explain that they will be making some hypotheses, collecting data, and documenting their findings. Explain to the class that they will be using different formulas to measure their heart rates and comparing them to the heart rates of animals. Ask them why they think it’s important to know their heart rate. Then ask them why they think it’s important to know the heart rate of animals living in a zoo.

**Step 2:** Once the students have finished their worksheets, have them share their hypotheses and findings.

**Step 3:** Put a bpm chart line on the board and have students help you place the animals from Elephant Odyssey on the chart. Discuss how they came to some of their conclusions. Replace any animals incorrectly placed on the chart and discuss the differences in their answers.

**Step 4:** As an extension activity, have students measure their pulse rates after exercising (e.g., running, jumping, marching). Have them graph the results and compare them to their resting rate.
The following animals are on exhibit at the San Diego Zoo’s Elephant Odyssey: Asian elephant, domestic camel, domestic horse, African lion, red diamond rattlesnake, black-tailed brush lizard, guanaco, and two-toed sloth.

The chart line below represents heartbeats per minute (bpm). Guess what each animal’s resting heart rate might be and place them on the chart below. Place humans on your chart too.

1. Take your carotid pulse for 10 seconds. Place two fingers on your Adam’s apple (trachea). Slide fingers directly left or right into the groove formed by the trachea and the neck muscles. The pulse of the carotid artery should be found. This artery supplies blood to the head and neck, so it is important not to press on both the right and left artery at the same time.

<table>
<thead>
<tr>
<th>number of seconds</th>
<th>number of heartbeats</th>
<th>multiply by 6</th>
<th>= heartbeats/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 seconds</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Take your radial pulse for 15 seconds. Using two fingers, find the groove in the wrist directly below the wrist. Place fingers to the outside of the tendon and press gently. You should feel a slight pulsation. This is the radial artery, which delivers blood to the hand.

<table>
<thead>
<tr>
<th>number of seconds</th>
<th>number of heartbeats</th>
<th>multiply by 4</th>
<th>= heartbeats/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 seconds</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Take your brachial pulse for 20 seconds. Lift one arm and flex your bicep muscle. Press two fingers into the groove created by the muscle and the bone about 6-7 inches from the inside of the elbow. The pulsing you feel is the brachial artery, which supplies blood to the arm.

<table>
<thead>
<tr>
<th>number of seconds</th>
<th>number of heartbeats</th>
<th>multiply by 3</th>
<th>= heartbeats/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 seconds</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Averaging your 3 bpm

<table>
<thead>
<tr>
<th>Carotid Rate</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brachial Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add for Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divide by 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Heart Rate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Does your bpm match where you put humans on your chart? Place your bpm on the chart.

6. Knowing your heart rate, does this change where you place the animals on your chart? If so, change your chart.

7. Give the reasons why you think some of the animals have a slower rate than you do.

8. Give the reasons why you think some of the animals have a faster rate than you do.

Be ready to share your answers with the rest of the class.
Adaptation: a change by which an organism becomes better suited to its environment

Carbon dioxide emissions: the act of discharging carbon dioxide into the air through such means as creating and using electricity or driving a car

Carbon footprint: the amount of carbon dioxide produced at a given time

Carnivore: an animal that eats only meat

Climate change: any long-term significant change in the weather that can be caused by natural or human-made conditions

Consumer: an organism that gets its food from another source, like a plant or animal

 Decomposer: an organism that breaks down plants and animals into simpler substances

Extinct: having no more living members (e.g., dinosaurs, dodo birds, mammoths)

Food chain: a series of organisms, each depending on the next as a source of food

Food web: a series of interrelated and interconnected food chains

Fossil: any remains, impression, or trace of a living thing from a past geologic time period

Glacier: a slowly moving mass or river of ice formed by the accumulation and compaction of snow on mountains

Herbivore: an animal that eats only plants

Humidity: the measurable amount of water vapor in the atmosphere

Ice Age: a series of glacial episodes during the Pleistocene epoch

Invertebrate: an animal without a backbone, such as a beetle, snail, or jellyfish

Land bridge: a strip of land that connects two landmasses

Landmass: a large continuous area of land

Larva: the active, immature form of an insect, especially one that differs greatly from its adult form (e.g., caterpillar)
Life cycle: the series of changes in the life of an organism, including reproduction

Mammal: a group of animals that have hair, are warm-blooded, give live birth, and produce milk to feed to their young

Megafauna: the large animals of a particular region, habitat, or geologic period

Metamorphosis: the process of transformation from an immature form to a mature form in two or more distinct phases

Migrate: to move from one region or climate to another

Omnivore: an animal that eats both plants and meat

Paleontology: the study of fossils and what they tell us about the ecologies of the past

Pleistocene epoch: the time period beginning about 1.8 million years ago and ending about 10,000 years ago

Producer: an organism that makes its own food using the sun as energy, such as a plant

Pupa: the inactive immature form of an insect, between its larval and adult forms (e.g., chrysalis)

Scavenger: an organism that feeds on dead organic matter