

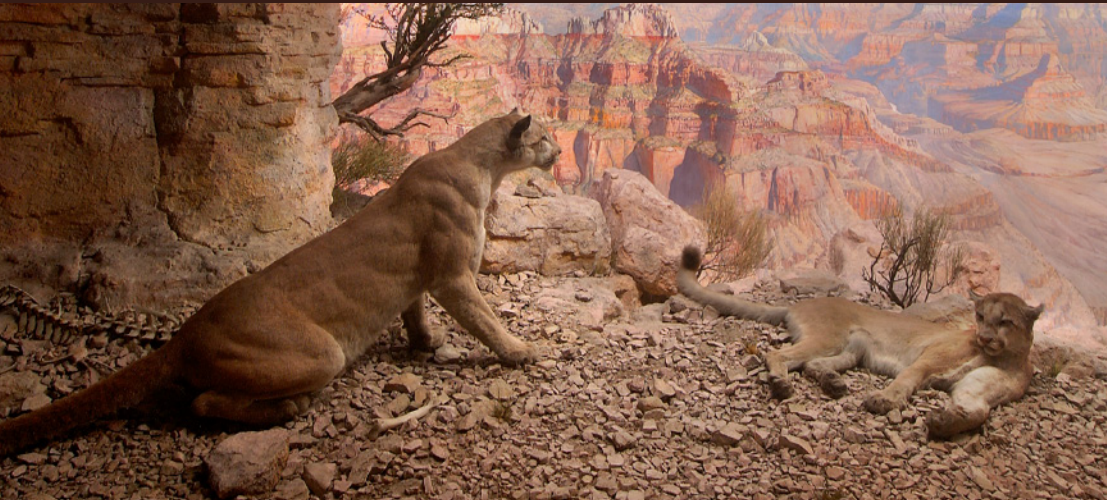
EDUCATOR'S GUIDE

THE JILL AND LEWIS BERNARD FAMILY

Hall of NORTH AMERICAN MAMMALS

INSIDE:

- Suggestions to Help You COME PREPARED
- ESSENTIAL QUESTIONS for Student Inquiry
- Strategies for TEACHING IN THE EXHIBITION
- MAP of the Exhibition
- ONLINE RESOURCES for the Classroom
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Essential QUESTIONS

Who are — and who were — the North American Mammals?

All mammals on Earth share a common ancestor and represent many millions of years of evolution. Most of those in this hall arose as distinct **species** in the relatively recent past. Their ancestors reached North America at different times. Some entered from the north along the **Bering land bridge**, which was intermittently exposed by low sea levels during the Pleistocene (2,588,000 to 11,700 years ago). These migrants included relatives of New World cats (e.g. sabertooth, jaguar), certain rodents, musk ox, at least two kinds of elephants (e.g. woolly mammoths), and bison. The second route from the south, along the **Isthmus of Panama**, formed about two million years ago. These migrants included porcupines, armadillos, and opossums. Scientists trace these ancient migrations by studying fossils, genetic and physical features, and geological evidence. Approximately 11,000 years ago, over 50% of North America's large mammal species went **extinct** due to climate change, human intervention, or some other cause. Today North America is home to roughly 500 mammal species, including humans.

How does geography affect the continent's mammal diversity?

Made up of Canada, the United States, and Mexico, the third largest continent contains two major mountain chains, an abundance of lakes and woodlands in the east, the prairies of the Great Plains, and deserts to the south and west. **Biomes** range from the tundra of Canada's Arctic Archipelago to Florida's near-tropical cypress swamps, and climate from four distinct seasons to two (wet/dry). The continent's position on the globe and geological history have also contributed to its variety of biomes. These in turn support an extraordinary range of mammals, from antelope to armadillo and moose to mouse.

In what habitats are mammals found?

The distribution of species on Earth depends largely on **climate** and vegetation. Some are found across large regions while others have limited ranges. In North America **temperate forests** predominate and are home to the greatest number of mammal species. Temperatures are moderate and precipitation is evenly distributed throughout the year, so food sources are diverse and abundant. **Grasslands** are also home to many very different mammal species. Summers are warm to hot and the climate is semiarid, with much precipitation in the form of snow. In the treeless northern plains known

as **tundra**, winters are cold, long, and dark, the growing season is extremely short, and precipitation is low. In contrast, the abundant precipitation and year-round warmth of **tropical** and **subtropical forests** provide optimal growing conditions that support the greatest diversity of species worldwide. Florida and Mexico contain some subtropical forest. In the **boreal forest** that covers a huge expanse of the continent's northern latitudes, winters are dry and severe, summers moist and short, and temperatures between the two range widely. **Desert** and **scrublands** are dry and generally warm throughout the year, with temperatures that may exceed 100°F and dip by 30 degrees at night.

How are mammals adapted to survive in these environments?

In order to survive, animals need to find food, evade predators, communicate and reproduce, and **adapt** to changing environmental conditions. For example, musk oxen stay put during the Arctic winter, relying on squat, woolly bodies to limit heat loss, while some caribou herds migrate to where snow is shallower, and breed and raise young quickly during the brief summers. Further south, some temperate forest-dwellers, like bears and some squirrels, conserve energy during the winter by hibernating.



Broad paws, fast reflexes, and excellent hearing and vision help the Canada lynx catch snowshoe hares, its primary food. The color of the hare's coat changes with the season, providing camouflage.

Changes in land use across the continent, like fewer small farms and fewer hunters, underlie both near-disasters and success stories. Wolves, cougar, bison, and the black-footed ferret are doing better now than when the hall first opened in 1942, as is the white-tailed deer, which thrives in suburbs. **Climate change** is now dramatically affecting some species in northern latitudes, like the wolverine and polar bear. Breeding programs and the creation of national parks have benefited others.



Glossary

adaptation: a physical or behavioral characteristic that helps an organism survive and reproduce in a particular environment

Bering land bridge: a narrow strip of land between present-day Alaska and eastern Siberia that has occasionally been exposed during the past 65 million years

biome: a major region, such as tundra or tropical rainforest, characterized by a particular community of living things

carnivore: an animal that eats primarily meat, whether scavenged or hunted

climate: the weather in a particular region averaged over a number of years

climate change: a long-term change in average global temperatures due to natural variation or human activity

extinction: occurs with the death of every member of a biological species. Most organisms that have lived on Earth are now extinct.

herbivore: an organism that eats primarily plants

ice ages: extended cold periods during which large parts of Earth's surface at high latitudes were covered in ice sheets (large continental glaciers).

Isthmus of Panama: the narrow strip of land that attained its current form about 2 million years ago and connects the continents of North and South America

omnivore: an animal that eats both plants and animals

species: a basic unit of biological classification. Members of a species share ancestry and characteristics and can interbreed and produce fertile offspring.

What is a mammal?

Modern mammals are a class of related vertebrate animals that includes placentals, marsupials, and monotremes. All mammals on Earth are descended from a common ancestor that lived in the time of dinosaurs. Mammals can look radically different from each other, but the underlying body plan is still strikingly similar and they share characteristics, like hair and the ability to nurse their young. Almost all North American mammals are placentals. Unlike the giants of the past, 85% of the 500 or so North American mammal species today weigh less than 2 pounds (1 kg). Most are rodents or bats.

Come Prepared

Plan your visit. For information about reservations, transportation, and lunchrooms, visit amnh.org/plan-your-visit.

Read the Essential Questions in this guide to see how themes in the hall connect to your curriculum. Identify the key points that you'd like your students to learn.

Review the Teaching in the Exhibition section of this guide for an advance look at the dioramas that you and your class will be encountering.

Download activities and student worksheets at amnh.org/namammals/educators. Designed for use before, during, and after your visit, these activities focus on themes that correlate to the New York State Science Core Curriculum.

Decide how your students will explore the Bernard Family Hall of North American Mammals.

- You and your chaperones can facilitate the visit using the **Teaching in the Exhibition** section of this guide.
- Your students can use the **student worksheets** to explore the exhibition on their own or in small groups.
- Students, individually or in groups, can use copies of the **map** to choose their own paths.

Correlations to Framework for K–12 Science Education

Your visit to the Bernard Family Hall of North American Mammals can be correlated to the new Framework for K–12 Science Education from the National Research Council.

Science Practices

Asking questions; Developing and using models; Analyzing and interpreting data; Obtaining, evaluating, and communicating information

Crosscutting Concepts

Patterns, Structure and Function, Systems and System Models

Core Ideas

LS1.A: Structure and Function; LS 1.C Organization for Matter and Energy Flow in Organisms; LS 1.D Information Processing; LS 2.A Interdependent Relationships in Ecosystems; LS 2.B Cycles of Matter and Energy Transfer in Ecosystems; LS 2.C Ecosystem Dynamics, Functioning and Resilience; LS 2.D Social Interactions and Group Behaviors; LS 4.C Adaptation

TEACHING IN THE Exhibition

This hall contains 43 magnificent dioramas that depict mammals across the continent in meticulously re-created landscapes. Text panels describe their biology and behavior, as well as the many other animals and plants that coexist in each habitat. The theme of the **guided explorations** below is **adaptations**. (*Possible answers follow each question.*) Numbers correspond to the map.

ENVIRONMENT

Organisms can survive only where their needs for food, water, and shelter are met, and where the climate is favorable. They must interact with the environment and the other organisms that share it. As environments change over time, some populations adapt and survive, some migrate, and some die out.

6. North American beaver: Beavers live both on land and in water. What adaptations allow them to be semi-aquatic? (*ears and nostrils that close, webbed hind feet, dense fur, flat tails that serve as rudders*) How do beavers affect their habitat and other species? (*cut down trees, build dams and nests; blocking streams expands wetland for other species*)



14. Caribou: These two males live high up on the alpine tundra. It's September. Where would they migrate, and why? (*As winter approaches, they walk to warmer environments where food is less covered in snow.*) What traits make them well-adapted to the cold? (*hair protects muzzles while foraging; broad hooves act as snowshoes and snowscrapers*)

20. Musk ox: This treeless, bleak terrain is known as tundra, where the ground thaws for just a month or two. Unlike caribou, musk ox do not migrate. How do they survive the extreme winters? (*huddling together; squat, woolly bodies limit heat loss*) What are the advantages and disadvantages of living in herds? (*safety in numbers; competition when food is scarce*)

29. Black bear: In colder climates black bears hibernate, conserving energy when food is scarce, but in the tropics this bear has no need to. Black bears are generalists — they eat almost anything. What's the benefit? (*They can adapt to a range of habitats and diets.*) What might it eat in this habitat? (*plants, fruits*)

30. Black-tailed jackrabbit & antelope jackrabbit: In the desert, the days are hot and water is scarce. What traits help the rabbits keep cool? (*huge ears shed body heat; long legs raise bodies above hot ground*) How do they get water? (*by eating water-storing plants like cacti*)

Adaptations

Animals have body parts that help them sense and respond to their environments. Many of these body parts serve multiple functions. These traits improve the ability of an organism to survive and reproduce. Adaptation is a result of natural selection.

15 & 16. Ice Age: By about 12,000 years ago the ice sheets that covered much of North America had shrunk significantly. Identify some of the large mammal species that went extinct at that time. What are some possible reasons? (*climate change, disease, meteorite impact, humans*)

MOVEMENT

Physical adaptations that include specialized toes, claws, paws, hooves, and tails allow mammals to move in different ways, in different kinds of habitats, and for different purposes.

7. Raccoon: Five-fingered forepaws and sensitive paw-pads help this omnivore find food. What is it doing? (*probing for crayfish under the shallow water, where it can't see very well*)

28. Eastern cottontail: Long, muscular legs enable these rabbits to make short or long hops in straight lines or zig-zags. When might that ability be useful? (*eluding predators; jumping is also part of courtship behavior*)



31. Mountain goat: What traits help these goats move swiftly along steep slopes? (*muscular forelimbs; two-toed hooves that can compress or spread out; flexible footpads*)

39. Northern flying squirrel: What body parts does it use to glide from tree to tree? (*a fold of skin between arms and legs stretches out to catch the air; tail acts as brake*)

INTERACTIONS

Mammals interact with other organisms in their environment in various, complex ways.

GROUPS

25. Coyote: The coyote cranes its neck. What is it doing, and why? (*howling, to summon its pack and warn other packs to stay away*)



27. Wolf: Can you spot the tracks of the deer that these wolves are chasing? What are the benefits of hunting in pairs or packs? (*Predators can catch much larger animals.*)

COMPETITION

22. Wapiti: What could happen to the ecosystem without predators to keep wapiti numbers in check? (*Young trees would be eaten before they could grow; competition with other plant-eaters would increase.*)

PREDATOR/PREY

4. Canada lynx & snowshoe hare: What traits help the lynx hunt? Help the hare hide? (*Lynx: fast reflexes, broad, well-furred paws, keen hearing and vision. Hare: big eyes and ears, fur provides camouflage, broad "snowshoe" hind feet.*)

8. Fisher & porcupine: The fisher's favorite prey is the porcupine. What traits make it a skilled hunter? How could the porcupine defend itself? (*Fisher: quick reflexes, low-slung bodies. Porcupine: tails with over 30,000 barbed quills.*)

FEEDING

All animals must obtain enough nutrition from plants, other animals, or both to live, grow, and reproduce.

HERBIVORE

18. Mule deer & 23. White-tailed deer: They have teeth specialized for chewing and they are ruminants (have stomachs adapted to thoroughly digest plant-based food). What are they grazing on? (*grasses, leaves*) What other kinds of food can you find? Scientists often study droppings to learn what animals eat. Can you find any in the white-tailed deer diorama?

CARNIVORE

1. Cougar & 2. Jaguar: These big cats stalk their prey, then kill with a swift pounce and bite. How might their colors and patterns help them hunt? (*Cougar: Sandy coat blends into rocks or sand. Jaguar: spots make body form harder to recognize in the forest.*) What do they hunt? (*deer, sheep, smaller mammals*) How do they use their claws, jaws, and teeth? (*retract claws to move silently; bite with powerful jaw muscles and large canine teeth; rear shearing teeth slice like scissors*)



OMNIVORE

11. Grizzly bear & 17. Alaska brown bear: While they vary in size, these bears are the same species. What are they eating here? (*Grizzly: insects, larvae, mosses. Alaska brown bear: salmon.*) How are they gathering food? (*Grizzly cubs: smelling, climbing, probing for insects. Alaska brown bear: catching salmon.*)

DEFENSE

Animals have multipurpose adaptations — both behaviors and body parts — that help them defend and protect themselves. Strategies include fighting, fleeing, and hiding.

10. Dall sheep: These sheep thrive above the tree line on windy mountain peaks. How do their coats and hoofs help keep them safe? (*Camouflage: whiter coats blend with snow, greyer coats with rocky mountainsides. Specialized hoofs enable them to climb to escape predators.*)

21. Caribou: It's the only species of deer in which both sexes have antlers. How are the antlers used? (*Males: defend against predators, compete for mates. Females: defend against predators, compete for food.*)



26. Spotted skunk & ringtail: Compare the defensive and offensive strategies of these small predators. (*The skunk's handstand warns ringtails not to approach; stiffened hair on the ringtail's tail makes it look larger. Distinctive patterns warn that both can spray foul-smelling secretions.*)

41. Nine-banded armadillo: While three-banded armadillos can protect themselves by rolling into a ball, this species can't curl up. How do they defend against predators? (*armored shells and large claws; can run surprisingly fast; can dig quickly*)

MATING & REPRODUCTION

Every animal develops strategies in order to identify and compete for a mate, reproduce, and raise its young.

9. Gray fox & opossum: Foxes are placentals (like humans). Opossum are marsupials (like kangaroos and koalas). What are the main differences between these two mammal groups? (*Placentals: longer pregnancy; large, robust newborns. Marsupials: shorter pregnancy; smaller newborns complete development in external pouch.*)

12. Moose: Male moose can grow antlers up to 6.8 feet (2.1 meters) wide. What does antler size signal to a female moose? (*Big antlers signal a healthy, vigorous mate.*) To a male moose? (*strength of an opponent*)



13. Bighorn sheep: Horn and body size determine rank. Which is the leader of this band? (*the ram on the right*) How do rams fight for ewes? (*by charging each other until one yields*)

Online RESOURCES

The Jill and Lewis Bernard Family
Hall of North American Mammals
amnh.org/namammals



The hall's official webpage highlights dioramas and the artists who made them.

Moose diorama

Extreme Mammals

amnh.org/exhibitions/extreme-mammals

The online guide to the Museum's past exhibition about remarkable extinct and living mammals.

The Smithsonian's North American Mammals

mnh.si.edu/mna

This database of all the continent's living mammals is searchable by location, species name, family tree, and conservation status.

National Parks Conservation Association: Wildlife Facts

npca.org/protecting-our-parks/wildlife_facts

Photos and facts about 26 animals in national parks from Alaska to Florida. Includes marine mammals.

The National Parks: Lesson Plans

pbs.org/nationalparks/for-educators/lesson-plans

Six downloadable lesson plans organized around the Ken Burns documentary *The National Parks: America's Best Idea*. Includes day trip activities, discussion guides, and storytelling modules.

Theodore Roosevelt Association: Lesson Plans

theodoreroosevelt.org/research/curriculum5to12.htm

Based on the National Standards, four detailed lesson plans about Roosevelt's life and legacy.

Science Bulletins

amnh.org/sciencebulletins

Videos, essays, and data visualizations about current research in the natural world. Look for the following BioBulletins:

- Protecting Wildlife in a Changing Climate
- Mammal Migration Under Threat
- The Last Wild Horse
- Wild at Heart
- Lemurs of Madagascar
- Cloning and Conservation



Wolverine in *Protecting Wildlife in a Changing Climate*

ZoOlogy

amnh.org/ology/zoology

The Museum's science website for kids ages 7 and up.

Look for the following activities, interactives, and resources:

- Moving Mammals
- Mammal Flipbooks
- Super Teeth
- In Pictures: Extreme Mammals
- Mammal Books & DVDs



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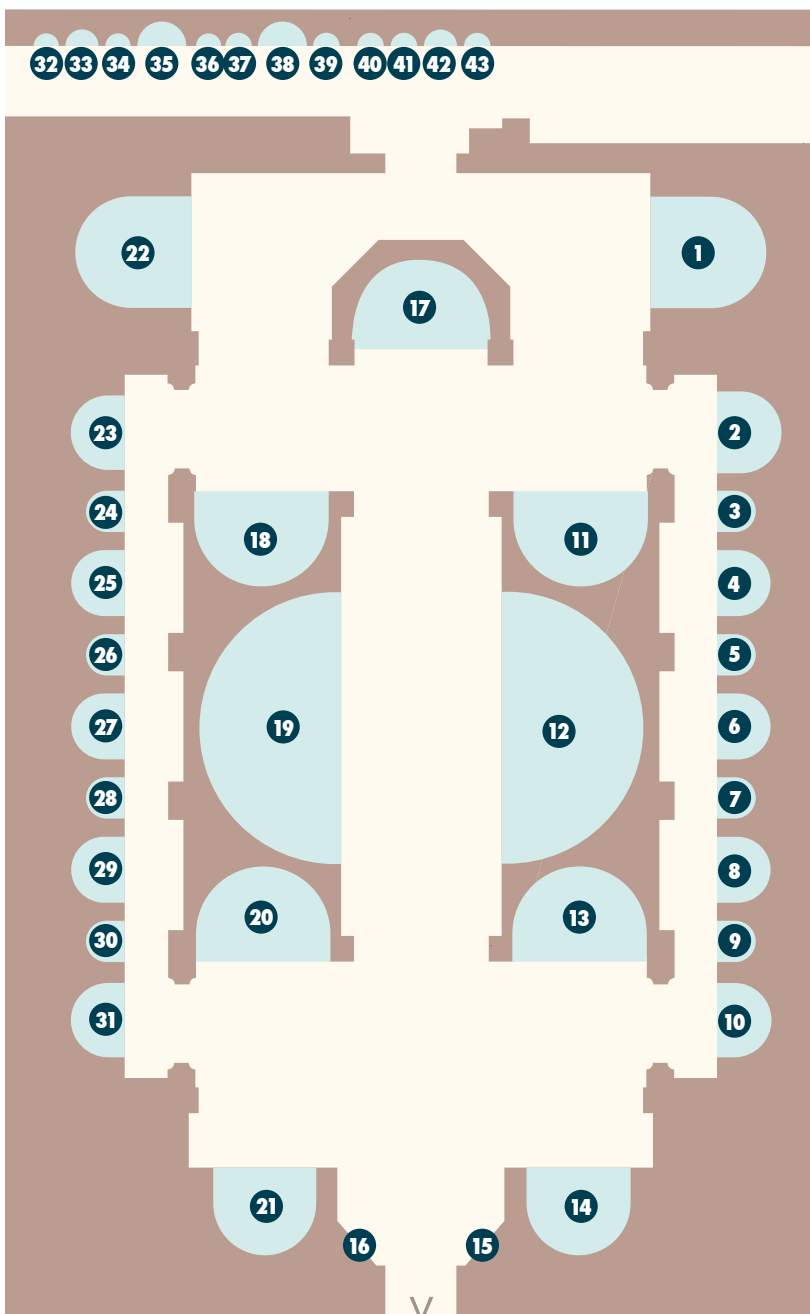
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Map Bernard Family Hall of North American Mammals

A Moment in Time

This hall depicts just a sample of North American wildlife today.

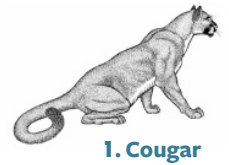
It highlights over 40 of the approximately 500 mammals native to Canada, the United States, and northern Mexico. Each diorama meticulously depicts the plants and animals of real places at a particular moment in time.



Theodore Roosevelt Memorial Hall

DIORAMAS

1. Cougar (mountain lion)
2. Jaguar
3. Western gray squirrel
4. Canada lynx & snowshoe hare
5. Sewellel (mountain beaver)
6. North American beaver
7. Raccoon
8. Fisher & porcupine
9. Gray fox & opossum
10. Dall sheep
11. Grizzly bear
12. Moose
13. Bighorn sheep
14. Caribou
15. Ice Age — Alaska
16. Ice Age — California
17. Alaska brown bear
18. Mule deer
19. American bison & pronghorn
20. Musk ox
21. Caribou
22. Wapiti (elk)
23. White-tailed deer
24. Striped skunk
25. Coyote
26. Spotted skunk & ringtail (cacomistle)
27. Wolf
28. Eastern cottontail
29. Black bear
30. Black-tailed jackrabbit & antelope jackrabbit
31. Mountain goat
32. American mink
33. American badger
34. Abert's squirrel
35. Wolverine
36. Ermine & southern red-backed vole
37. American marten
38. Collared peccary
39. Northern flying squirrel
40. Groundhog
41. Nine-banded armadillo
42. North American river otter
43. Black-footed ferret



NORTH AMERICAN Biomes

North America supports a variety of biomes — zones with distinct climates, plants, and animals. Organisms evolve adaptations to thrive in a biome. Some mammals can live in a number of biomes, especially when given space and protection from hunting and other stresses. Others survive only in a tiny zone of suitable conditions.

Boreal Forest

The largest terrestrial biome, these evergreen forests extend across much of subarctic North America and Eurasia. Winters are long and cold. More species survive here than in tundra, but fewer than in temperate or tropical forests.

Desert and Scrubland

These regions receive less than 25 cm (10 in) of precipitation per year. Days can be incredibly hot and nights very cold. Water shortage and temperature extremes foster unusual plant and animal adaptations. Deserts cover about one fifth of Earth's surface.

Grassland and Shrubland

Also called prairie or plains in North America, these regions are dominated by grasses instead of large shrubs or trees. This biome is somewhat dry, with very hot summers and very cold winters. Animals that eat grasses thrive here.

Temperate Forests

These forests are found in the middle latitudes with deciduous trees, evergreens, or a mix. Temperatures rise and fall with the seasons, but are seldom extreme. Because of the relatively mild, or “temperate,” climate, a broad range of species can live here.

Tropical and Subtropical Forests

They are forests that are closer to the equator, often moist, and warm all year. This hospitable climate fosters a rich diversity of plants and animals — more species than in any other biome.

Tundra

The coldest biome, this treeless plain occurs primarily in a belt around the Arctic Ocean. Few organisms have adapted to survive it. There are no trees, and plants grow close to the ground, which is frozen most of the year. Tundra occurs both in the Arctic and at the tops of high mountains.



Theodore Roosevelt MEMORIAL HALL

America's Conservation President

Theodore Roosevelt — governor of New York and 26th president of the United States — was an ardent naturalist and visionary conservationist. This hall, New York State's official memorial, celebrates Roosevelt's passion for preserving America's wilderness for future generations and the Museum's ongoing commitment to this legacy worldwide.



2 Firsthand Observer

1880–1900 (age 22 to 42)

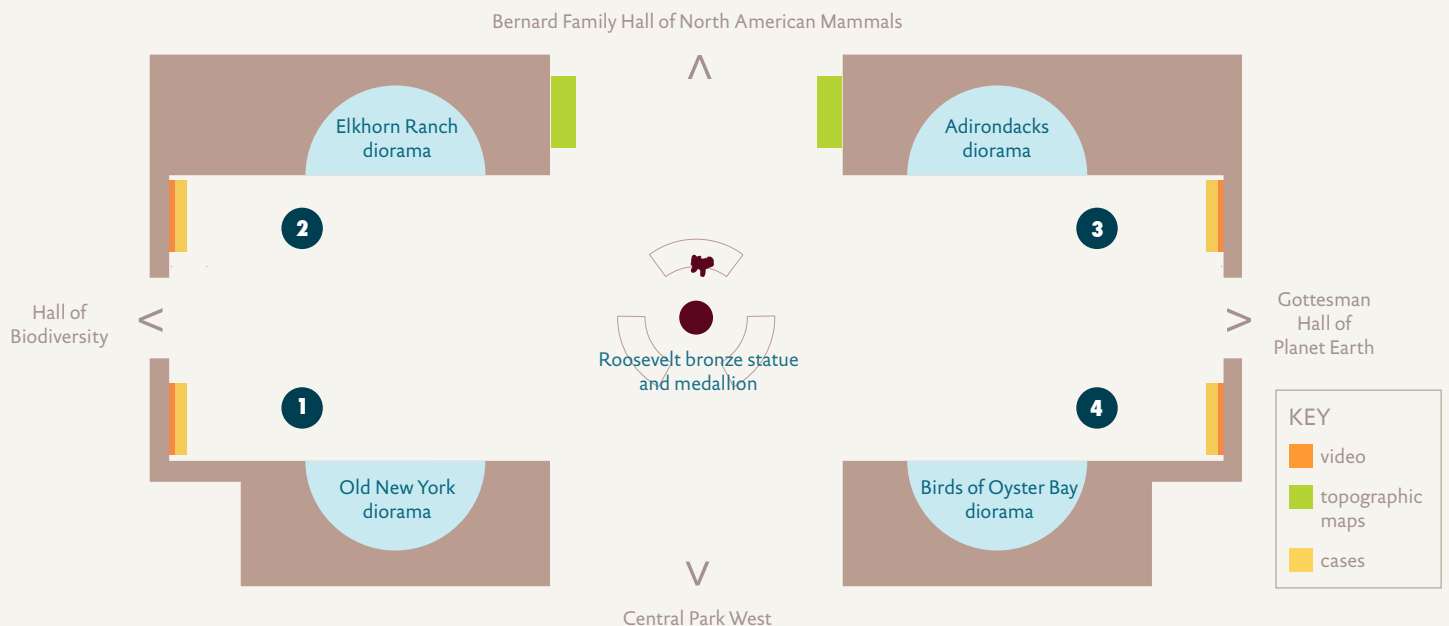
While in the American West, the young sportsman, politician, and writer recognized the need for wildlife and habitat protection.



3 Conservation President

1901–1909 (age 42 to 50)

Roosevelt used his presidential powers to make environmental preservation a responsibility of the federal government.



1 Young Naturalist

1858–1880 (birth to age 22)

A nearsighted and asthmatic child, Roosevelt nonetheless loved being outdoors and planned to become a naturalist.



4 Lifelong Explorer

1909–1919 (age 50 to 60)

Travels to other continents fed the former president's lifelong curiosity about the world's wildlife and its peoples.

Explore More

In the Bernard Family Hall of North American Mammals

As president, Roosevelt protected land in national parks, monuments, forests, and wildlife refuges. Check out some of these places in the following dioramas: **American marten** (Crater Lake National Park), **coyote** (Yosemite Valley), **mule deer** (Devils Tower, Wyoming), and **cougar** (Grand Canyon).

Throughout the Museum

amnh.org/apps/explorer

Download the Museum's free Explorer App for your iPhone/iPod and take the Theodore Roosevelt tour.



Theodore Roosevelt Teaching in the Exhibition

The four sections in this memorial hall represent Theodore Roosevelt's roots in New York City, his years in the West, and his conservation legacy as sportsman, statesman, and explorer.

1 Young Naturalist

As a boy Roosevelt not only closely observed the natural world but described what he collected — and even mounted some of his specimens.

- **Roosevelt's books, notebooks, sketches, taxidermy tools, and specimens:** Draw students' attention to the ways in which Roosevelt recorded his explorations of the natural world. Ask students what tools they might take into the field today. (*measuring tools, field journal, drawing pencils, camera*)

2 Firsthand Observer

Time in the Badlands of North Dakota opened Roosevelt's eyes to the need to protect bison and other animals from being hunted to extinction. He had a special interest in protecting birds.

- **Passenger pigeon, egret feathers, Audubon illustration, and photos of ladies' hats:** Have students explore the different ways people think about birds. (*part of nature, source of food, for hunting, fashion inspiration*)

Other Things to Look Out For:

- **Timelines:** In each section, explore Roosevelt's life and times through printed timelines on label decks and interactive ones on the kiosks.
- **Bronze statue & medallion:** This statue shows Roosevelt in the rugged clothes he wore on a trip to Yosemite two years into his presidency. The medallion depicts a bison, a species whose near-extinction inspired Roosevelt to establish wildlife preserves.
- **Interview videos:** Commentators, including historians and policy makers, discuss Roosevelt's conservation legacy.
- **Topographic maps:** Examine the Grand Canyon and Olympic National Park, two areas preserved by Roosevelt.

NCSS Standards

- Describe how people create places that reflect cultural values and ideals (Time Continuity and Change)
- Describe personal connections to place (Individual Development and Identity)
- Apply knowledge of how group's and institutions work to meet individual needs and promote the common good (Individuals, Groups, and Institutions)

3 Conservation President

As president, Roosevelt set aside some 230 million acres — an area more than twice the size of California — in national parks, monuments, forests, and wildlife refuges.

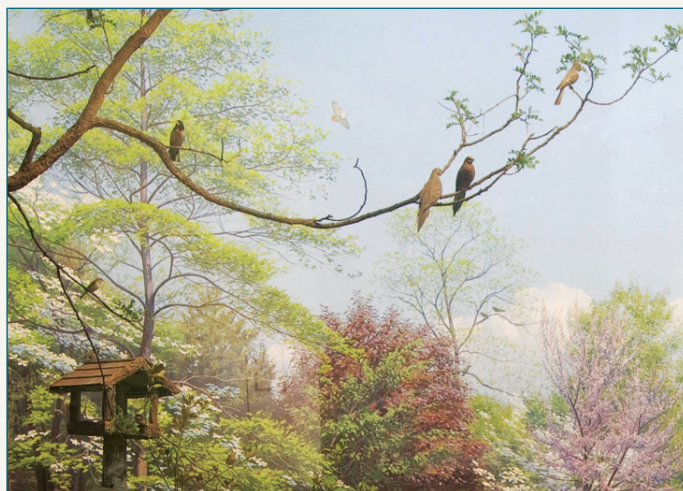
- **Overhead videos, artifacts, and maps:** Have students imagine what might have happened to these areas if Roosevelt had not protected them. (*Areas may have been developed, transformed, or destroyed.*)

“Let us hope that the camera will largely supplant the rifle.” — Roosevelt

4 Lifelong Explorer

After leaving the presidency, Roosevelt helped lead an expedition to map an uncharted river in Brazil. He also set out for Africa to hunt and collect specimens, and traveled to the southwestern United States.

- **Artifacts and specimens:** Invite students to explore items that represent Roosevelt's travels. Where did he go and what did he bring back? (*Navajo and Hopi reservations, South America, and Africa; Hopi dance wands, ceramics, and doll; Nambiquara necklace*)



Birds of Oyster Bay Diorama. An avid amateur ornithologist, Roosevelt began bird-watching as a teenager in Oyster Bay, New York, and published a list of local species at age 20. Students can observe the variety of birds in this diorama and choose one to identify, sketch, and describe.

