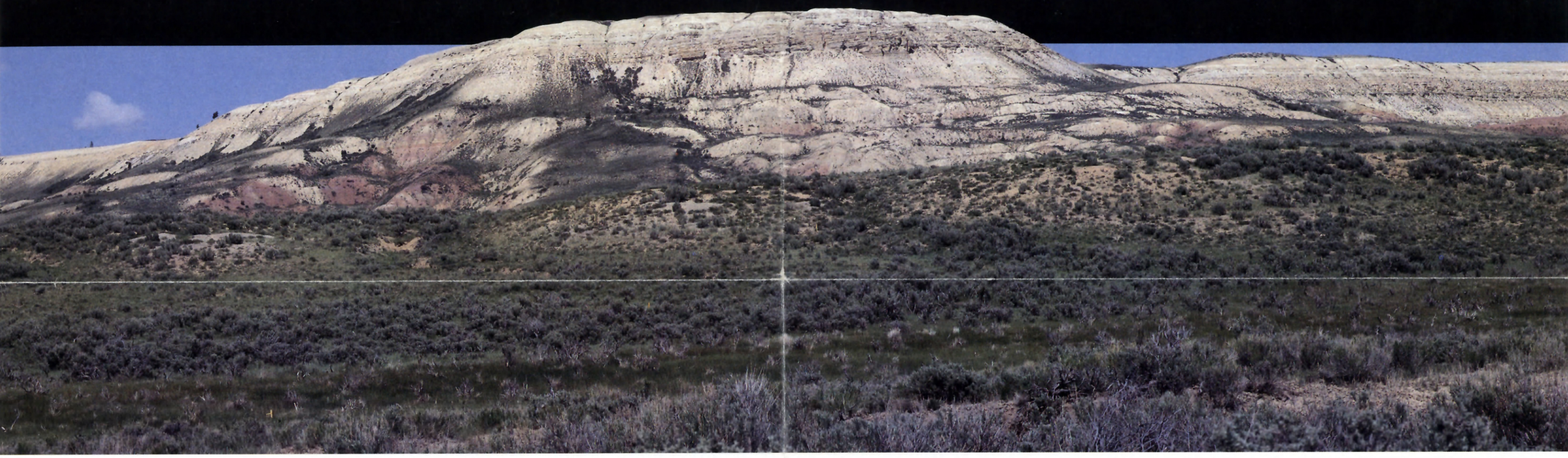
Fossil Butte

Fossil Butte National Monument
Wyoming

National Park Service
U.S. Department of the Interior



Three ancient great lakes existed in the region of Wyoming, Utah, and Colorado 50 million years ago—Lake Gosiute, Lake Uinta, and Fossil Lake, the smallest. All are gone today, but they left behind a wealth of fossils in lake sediments that turned into the rock layer known as the Green River Formation, made up of laminated limestone, mudstone, and volcanic ash. The fossils are among the most nearly perfectly preserved remains of ancient plant and animal life in the world. Some of the most extraordinary of these fossils came from Fossil Lake, represented today by a flat-topped remnant of rock that stands where the center of Fossil Lake once was. Fossil Butte National Monument preserves the butte and its invaluable, fascinating record of the past.

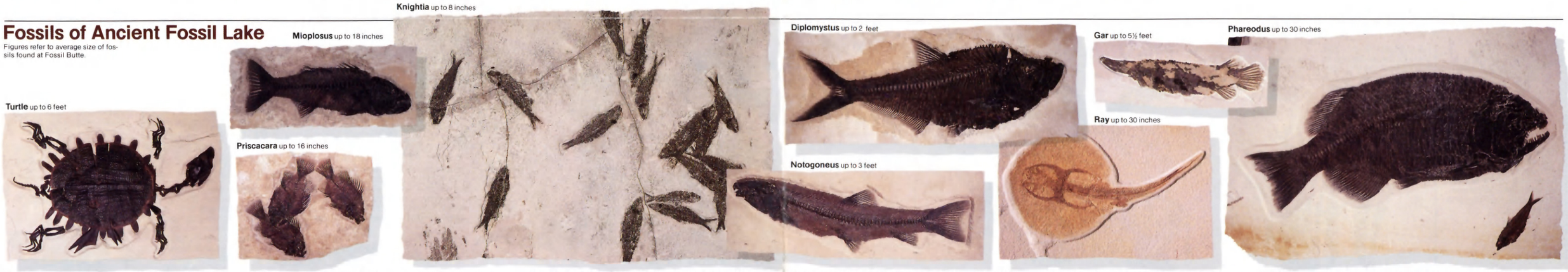
The fossils of Fossil Lake are remarkable for their numbers and the broad spectrum of species found here—more than 20 kinds of fish, 100 varieties of insects, and an as yet uncounted number of plants. Paleontologists, the scientists who study fossils, and private collectors have unearthed thousands of specimens during the past 100 years. Many billions more lie buried in the butte and surrounding ridges, protected and preserved for future paleontologists to study. The fossils are remarkable for their detail. Many of the fish, for example, retain not only their entire skeletons but their teeth, delicate scales, and skin as well. And perhaps most remarkable of all is the story the fossils tell of an ancient life and landscape.

The scene 50 million years ago, during the Eocene Epoch of the Cenozoic Era, was quite different from that today. Fossil Lake, 50 miles long and 20 miles wide at its maximum, nestled among mountains in a lush green forest of palms, figs, cypress, and other subtropical trees and shrubs. Willows, beeches, oaks, maples, and ferns grew on the lower slopes, and on the cool mountain sides was a spruce and fir forest. In and around the warm waters of the lake, animal life was diverse and abundant. A broad range of fish inhabited the tributaries, shallows, and deep water of Fossil Lake during its unusually long life of more than 2 million years. Gars, paddlefish, bowfins, and stingrays, though they may appear primitive to some, still survive today, as do herring, perch, and mooneyes. The lakeshore was alive with crocodiles and turtles; insects, dog-sized horses, and early primates inhabited the land; birds and bats mastered the air.

This vibrant scene is gone now because of profound climate changes and the disappearance of the lakes. But the site of ancient Fossil Lake and many of the fossils that tell its story will be protected in perpetuity at Fossil Butte National Monument. Here, paleontologists and park visitors alike can discover the past.

Fossils of Ancient Fossil Lake

Figures refer to average size of fossils found at Fossil Butte.



For number, variety, and detail of fossil fish, few places can equal ancient Fossil Lake. Its fossils enable us to take a close look at what life was like at Fossil Lake 50 million years ago. Fish are the most common fossils by far. Millions of herrings that swam in schools are preserved as images-in-stone. Specimens of bigger predatory fish, such as 5-foot-long gars and a 4-foot-long bowfin, are rarer. Altogether more than 20 species of freshwater fish have been identified at Fossil Lake; many are recognizable as ancestors or close cousins of some of today's species. Besides the fossil fish, there are hundreds of other forms of life captured in stone. The delicate bones of a fossil bat, the oldest known in North America, and a remarkably complete fossil snake were preserved here. Snail shells, insect impressions, crocodiles, freshwater turtles, bird skeletons, feather impressions. and plant remains—leaves, seeds, stems, and flowers blown or washed out into the lake—these, and more, are part of the buried treasure of fossils unearthed at Fossil Lake.

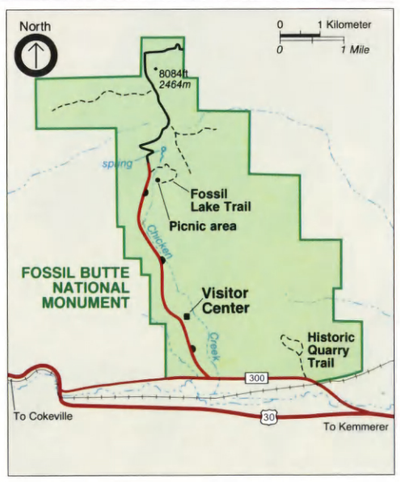
Ideal Conditions for Fossil-Making What events led to the preservation of so much of Fossil Lake's life as fossils? No one knows for sure, but after careful study scientists have developed theories to explain the process. One essential ingredient for preservation, they believe, was rapid burial in calcium carbonate, which precipitated out of the water and fell like a constant gentle rain to the bottom of Fossil Lake. Whatever sank to the bottom—dead fish, fallen leaves—was covered by this protective blanket. Year after year for hundreds of thousands of years, this reoccurred. Some of the most perfectly preserved fossils come from the deep-water sediment layers of whitish to buff-colored calcite limestone alternating with brown oil shale commonly called the 18-inch layer. The fossils are generally adult fish. An equally important fossil-bearing layer comes from nearer the lake shallows and is composed of a lighter-colored limestone with faint lamination that splits easily due to the lack of organic material. Thus, its name: the split-fish layer, which averages 6½-feet thick. Here one finds younger fish and species that would have survived better in the near shore shallows—crayfish and stingrays, for example.

Unsolved Mysteries While many of Fossil Lake's animals and plants probably died natural deaths, on several occasions huge numbers of fish were killed suddenly. These die-offs are recorded on great slabs of the Green River Formation called mass mortality layers. What killed these fish? A superbloom of blue-green algae that emitted poisons into the water? A sudden change in water temperature or in salinity? All of these? Ongoing research may solve the mystery.

The Park Today

Fossil Butte National Monument today is a semi-arid landscape of flat-topped buttes and ridges dominated by sagebrush, other desert shrubs, and grasses. It might be hard to imagine that 50 million years ago a lake teeming with life existed here in the midst of a subtropical climate. But the evidence is in the rocks around you.

In the park, the Green River Formation, which consists of the lake sediments of Fossil Lake, appears as layers of tan-buff-colored sedimentary rock near the top of Fossil Butte and surrounding ridges. It is in this 200- to 300-foot-thick formation that millions of fish and other fossils are found. Other fossil-bearing rock formations, laid down at different times or at different sites, also exist here. The most prominent is the red, pink, and purple Wasatch Formation—a stream deposited layer underlying, interfingering, and overlaying the Green River Formation—that has yielded the fossil remains of primitive horses, a rhino-sized mammal known as Coryphodon, early primates, crocodiles, turtles, lizards, and plants. Fossils are best discovered at the visitor center museum. If you happen to see fossils along the park's two fossil trails, or elsewhere, leave them undisturbed. And while you're here take time to enjoy the life and landscape of the park.



Visitor Center

The visitor center is a good place to start your exploration of the park. The center is open every day except for winter holidays. A museum has displays of fossils and an artist's re-creation of what this area may have looked like in the time of ancient Fossil Lake, as well as other exhibits. Books and brochures are available, and park rangers can help plan your visit. A schedule of events, including guided walks, is posted.

Trails Two park trails offer an opportunity to experience Fossil Butte and its fossil story firsthand. The **Quarry Trail,** a 2½-mile-long loop trail, climbs up Fossil Butte to the site of a fossil quarry in the Green River Formation that was worked from the late 1800s to the 1970s. Trailside exhibits recount some of the history of fossil collecting. Along the trail is a cabin once used by fossil hunters. The 1½-mile **Fossil Lake Trail** provides a closeup view of the flora and fauna in the park. It winds through an aspen grove, high desert landscape, and near a beaver pond. The record of the past can be seen in rock exposures of the Green River Formation; today's life and landscape are all around you. Trailside exhibits interpret the area's natural history, past and present.

Crosscountry hiking is permited.

Today's Natural World Besides its fossil resources, the park protects other natural features. Wildlife-watchers may see mule deer, moose, elk, pronghorn, coyotes, golden and bald eagles, and a variety of other birds in this land of sagebrush, grass, and scattered aspen groves, willow thickets, and pine-fir stands. Wildflowers bloom seasonally. In whatever season you visit, come prepared. Temperatures range from the 90s°F in the summer to sub-freezing in the winter. Precipitation averages only 9 inches per year, and more than half falls as snow. Strong winds are common.

Picnic Area A picnic area, located in an aspen grove, has tables, fire grills, restrooms, and drinking water.

Nearby Visitor Services The town of Kemmerer, located 10 miles east of the park, has lodging, a campground, restaurants, grocery stores, and gasoline stations. Public campgrounds are in Bridger-Teton National Forest north of the park.

Administration Fossil Butte National Monument is a unit of the National Park System, which consists of more than 360 parks representing important examples of our country's natural and cultural inheritance. For more information, write: Superintendent, Fossil Butte National Monument, P.O. Box 592, Kemmerer, WY 83101; or call 307-877-4455.

Fossil Collecting, Past and Present

Some of the first fossil fish from the Green River Formation were collected by geologist Dr. John Evans in 1856 and described scientifically by Joseph Leidy. Not all early collectors were scientists; Union Pacific Railroad workers discovered the "Petrified Fish Cut" near Rock Springs station in the 1860s. A few years later the railroad was routed near Fossil Butte. Other collectors were men and women—sometimes whole families—fascinated by the fossils they found. Robert Lee Craig, who quarried fish from Fossil Butte and Fossil Ridge to the south, spent 40 years, from 1897 to 1937, quarrying and preparing fish for museums and private collections throughout the world. David C. Haddenham worked the Fossil Butte sites for more than 50 years in this century.

Several families have come to the basin for what has amounted to a life's work for many of them.

Many of the countless fossils they dug out and carefully prepared are studied and exhibited today in museums across the United States, including the Field Museum in Chicago, the American Museum of Natural History in New York, the University of Wyoming Geological Museum at Laramie, and the Smithsonian Institution's National Museum of Natural History in Washington, D.C. The extensive collections reflect the toils of private and scientific collectors of the past 100 years.

Today collecting continues outside the park on private lands and on Wyoming state lands leased by permit only. Rare finds on state lands are turned over to the University of Wyoming for scientific study. Collecting within Fossil Butte National Monument is now limited to special permit research projects that will further scientific understanding of Fossil Lake. Other collecting is disallowed by the Antiquities Act of 1906 that makes it illegal to remove or injure "objects of antiquity" found on federal lands.

To Preserve

Since Fossil Butte National Monument was established in 1972, fossils and related geologic features within its boundaries have been protected, as have all natural and historic features. Do not disturb, damage, or remove any fossil; report a discovery to a park ranger. And, for a safe, pleasant visit, please:

- Carry water with you when hiking.
- Watch your footing when climbing loose, rocky talus slopes.
- Build fires only in picnic area grills.
- Use caution when driving the park's unimproved roads, which can become impassable when wet.

Photo credits *Lance Grande and Field Museum, Chicago: Diplomystus, Mioplosus, Notogoneus, Phareodus; Dennis Henry: Priscacara, Ray, Turtle; National Park Service: Gar, Knightia.*

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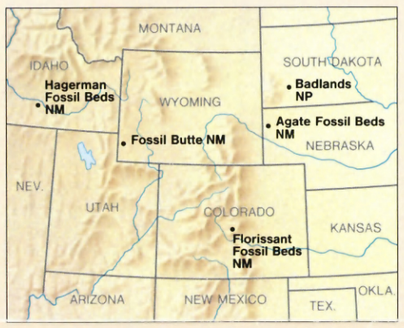
The Age of Mammals

Life in the Cenozoic Era—the Last 65 Million Years

From simple beginnings, endless numbers and countless varieties of life forms have evolved and populated the Earth. For 140 million years prior to the Cenozoic Era, dinosaurs held dominion over the land. Mammals existed, too, but they were small and not particularly abundant. As the dinosaurs perished, the mammals took center stage. Even as mammals increased in numbers and diversity, so, too, did the birds, reptiles, fish, insects, trees, grasses, and other forms of life. The fossil record gives us a fascinating glimpse into the Cenozoic Era. Without fossils, we would have no way of knowing that ancient animals and plants were any different from today's. With fossils, we discover that an extraordinary procession of creatures lived in North America and around the world. Species changed as the epochs of the Cenozoic Era passed. Those that could tolerate the changes in the environment survived; those that could not were doomed to extinction. The fossil record reveals the story of both. Yet, the study of fossil remains—paleontology— raises many questions. Paleontologists look beyond the fossils and ask new questions about the types of environments these plants and animals lived in and how they adapted to climatic changes. These scientists study how different groups of plants and animals interrelate, and how they have changed through time. Fossils are studied in the context in which they were found and as one element among a community of organisms. Every fossil can serve as a key to unlock knowledge, and the National Park Service is especially concerned with the protection of these keys as the questions unfold. As the Cenozoic Era continues today, scientists estimate that up to 30 million species of animals and plants inhabit the Earth now, a mere fraction of all the forms of life that have ever existed. Scientists believe that about 100 species will become extinct every day, a rate much faster than at other times in Earth's history. The pollution of the air and water, the destruction of forests, grasslands, and other ecosystems, and other adverse changes to the Earth's environment challenge life's very ability to survive. One Finnish scientist, Björn Kurten, put it this way: "Looking back on the long panorama of Cenozoic life, I think we ought to sense the richness and beauty of life that is possible on this Earth of ours. . . . And we should also realise that man, who is now planning for his own or the next generation, must begin to plan . . . for the geological time that is ahead. . . . It may stretch as far into the future as time behind us extends into the past."

Fossils in the Parks
The illustrations below are just a sampling of the plants and animals found in the Cenozoic Era. They are based on fossils found at National Park System sites, whose addresses are: Agate Fossil Beds NM, P.O. Box 27, Gering, NE 69341; Badlands NP, P.O. Box 6, Interior, SD 57750; Florissant Fossil Beds NM, P.O. Box 185, Florissant, CO 80816; Fossil Butte NM, P.O. Box 592, Kemmerer, WY 83101; and Hagerman Fossil Beds NM, 963 Blue Lakes Blvd., Suite 1, Twin Falls, ID 82551.



The North American Scene

Paleocene
Began 65 million years ago

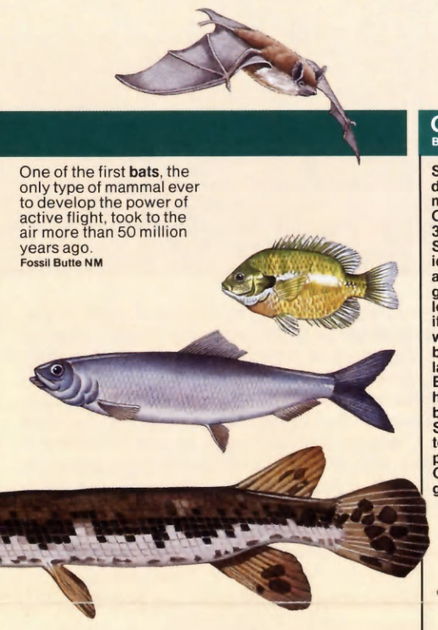
The Paleocene Epoch began after the extinction of the dinosaurs. Mammals that had lived in the shadows of dinosaurs for millions of years eventually evolved into a vast number of different forms to fill the newly vacant environmental niches. Many early mammal "designs" of this time would soon become extinct; others would survive and then evolve into other forms. The variety of birds, other animals, and plants increased, and species became more specialized. Although dinosaurs were gone, reptiles lived on in the form of crocodiles, lizards, and snakes.

At the beginning of the Paleocene, most mammals were tiny like this rodent-like **multituberculate**. With time, mammals grew in size, number, and diversity.

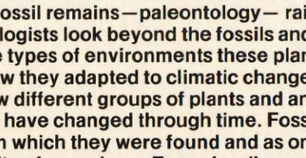
Palm trees and **crocodiles** thrived in the subtropical forests of the Paleocene and much of the Eocene.
Fossil Butte NM

Eocene
Began 58 million years ago

In the Eocene Epoch, mammals emerged as the dominant land animals. In addition, they took to the air and the sea. The increase in the diversity of mammals that had begun in the Paleocene continued at a raprid pace. There were many variations in life forms. For example, some of the earliest giant forms of mammals arose in the Eocene. Some were successful, some not. Although the fossil record reveals that many mammals were quite unlike anything we can see today, increasingly there were many forest plants, freshwater fish, and insects that were much like those of today.



Many freshwater fish swam in North American lakes of the Eocene. **Gars** (bottom), **herring** (middle), and **perch** (top), are similar in appearance to these Eocene fish.
Fossil Butte NM



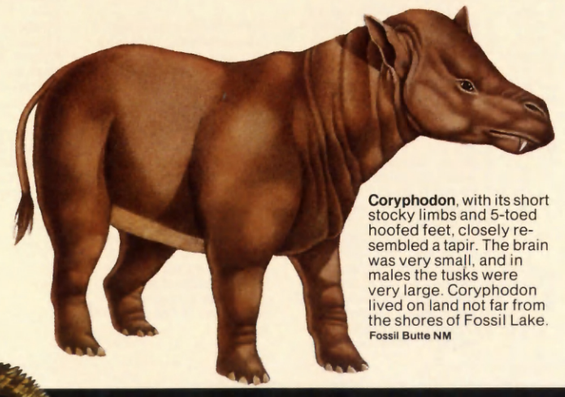
One of the first **bats**, the only type of mammal ever to develop the power of active flight, took to the air more than 50 million years ago.
Fossil Butte NM

An explosion in the varieties of flowering plants just before, during, and after the Eocene Epoch would populate the land with all sorts of new species of trees, shrubs, and smaller plants. **Cattails** grew in the shallow water along the edges of Eocene freshwater lakes.
Fossil Butte NM

The delicate bones of shorebirds, including **frigate birds**, are preserved in the fine-grained sediment of Eocene lake deposits.
Fossil Butte NM

Ancient tapirs such as **Heptodon** browsed not far from the shores of Fossil Lake. Unlike modern tapirs, **Heptodon** had a very small snout.
Fossil Butte NM

The first **horse-like** creatures lived in Eocene forests. They were barely bigger than today's domestic cat. Throughout the Cenozoic Era their size increased; their legs became longer and their feet changed from many-toed to single-hoofed, for faster running. Their teeth became adapted from browsing to grazing. Just a few of the species in the evolutionary history of horses are shown here in silhouette across this page. Fossil horses occur at many National Park System sites.



Coryphodon, with its short stocky limbs and 5-toed hoofed feet, closely resembled a tapir. The brain was very small, and in males the tusks were very large. Coryphodon lived on land not far from the shores of Fossil Lake.
Fossil Butte NM

Oligocene
Began 37-34 million years ago

Scientists are now conducting research that may move the Eocene/Oligocene boundary to 34 million years ago. Such changes in geological time divisions may be an issue of debate for generations to come, leading to some ambiguity. The Oligocene Epoch was a time of transition between the earlier and later parts of the Cenozoic Era. The climate, which had been warm and moist, became cooler and drier. Subtropical forests began to give way to more temperate forests. Late in the Oligocene, savannas—grasslands broken by scattered woodlands—appeared. Influenced by these changes, mammals, insects, and other animals continued the trend toward specialization. Some adapted to the diminishing forests by becoming grazers. Early types of mammals continued to die out, as more modern groups—dogs, cats, horses, pigs, camels, and rodents—rose to new prominence.

Butterflies and many other insect groups evolved with the increasing numbers and variety of flowering plants and became important agents of pollination.
Florissant Fossil Beds NM

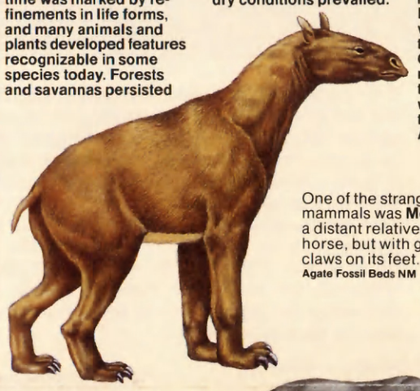
Tsetse flies occur today in tropical Africa and as fossils in the Florissant formation.
Florissant Fossil Beds NM

Groves of giant **redwood** trees were found throughout western North America. Changes in climate were responsible for the shrinking range of the redwood forests.
Florissant Fossil Beds NM

Oreodonts, a group of sheep-like animals, were successful in the Eocene and Oligocene but by the end of the Miocene had completely died out.
Badlands NP

Miocene
Began 24 million years ago

The abundance of mammals reached a peak in the Miocene Epoch. The time was marked by refinements in life forms, and many animals and plants developed features recognizable in some species today. Forests and savannas persisted in some parts of North America; treeless plains expanded where cool, dry conditions prevailed. Many mammals adapted for life on the prairie by becoming grazers, runners, and burrowers. Large and small carnivores evolved to prey on these plains-dwellers. Great intercontinental migrations occurred throughout the Miocene, with various animals entering and leaving North America.



One of the strangest of all mammals was **Moropus**, a distant relative of the horse, but with great claws on its feet.
Agate Fossil Beds NM

Lacking other defenses, some larger rodents, like the dry-land beaver **Palaeocastor**, lived in colonies beneath the High Plains of North America. Their burrows remain as trace fossils.
Agate Fossil Beds NM

Rhinos, varied and abundant during most of the Cenozoic Era, ranged in size around the world from the 3-foot tall North American species **Menoceras** (shown here) to a giant Asian species that is the largest land mammal yet found in the fossil record.
Agate Fossil Beds NM

The earliest true dogs of the Oligocene Epoch evolved into carnivores such as **Daphoenodon**, a hunter with characteristics common to both dogs and bears.
Agate Fossil Beds NM

Dinohyus, "the terrible hog," had bone-crushing teeth, which allowed it to scavenge the remains of other grassland animals.
Agate Fossil Beds NM

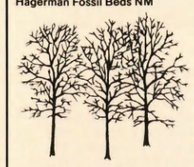
The tiny gazelle-camel **Stenomylus** probably grazed in herds for protection against predators.
Agate Fossil Beds NM

Pliocene
Began 5 million years ago

Most of the life-forms of the Pliocene Epoch would have been recognizable to us today. Many individual species were different, but distinguishing characteristics of various animal and plant groups were present. Evidence of wet meadows and dry open grassland environments have been found in the Pliocene. Toward the end of this period grasslands spread across much of North America, brought on by an ever cooler, ever drier climate. Horses and other hoofed mammals and the powerful, intelligent predators that preyed on them continued to prosper.

Mastodons migrated to North America during the Pliocene. They were later joined in the early Pleistocene by another elephant group called mammoths. By the late Pleistocene, both mammoths and mastodons had become extinct, possibly due to climatic changes or hunting by paleoindians.
Hagerman Fossil Beds NM

Willow, alder, **birch** and elm grew on the ancient river plains of the Pliocene. These same plants are found in riparian habitats today.
Hagerman Fossil Beds NM

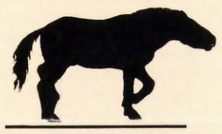


Horses such as this early zebra-like version of the modern-day horse were superbly adapted to life on the grassy plains.
Hagerman Fossil Beds NM

Quaternary
Began 2 million years ago

The Quaternary Period, in which we live today, is characterized by dramatic changes. The Pleistocene Epoch, a time when glaciers covered much of North America, started with widespread migrations of mammals and ended with massive extinctions. The oldest record of human occupation in North America is around 12,000 years ago. In the time that human beings have inhabited North America, we have had a profound effect on its other animals and plants. Will we preserve the diversity of life so richly celebrated in the Cenozoic?

Endangered species today include the **loon** (top), **timber wolf** (middle), and **Kemp's ridley sea turtle** (bottom). The National Park Service is among the many public and private agencies entrusted with helping to protect these animals and to preserve the diversity of life throughout North America.



Illustrations by Karen Barnes are based on fossil reconstructions found in R.J.G. Savage and M.R. Long's *Mammal Evolution: An Illustrated Guide*, New York: Facts on File Publications, 1986.

The drawings are not to scale.

Tree illustrations by John Dawson