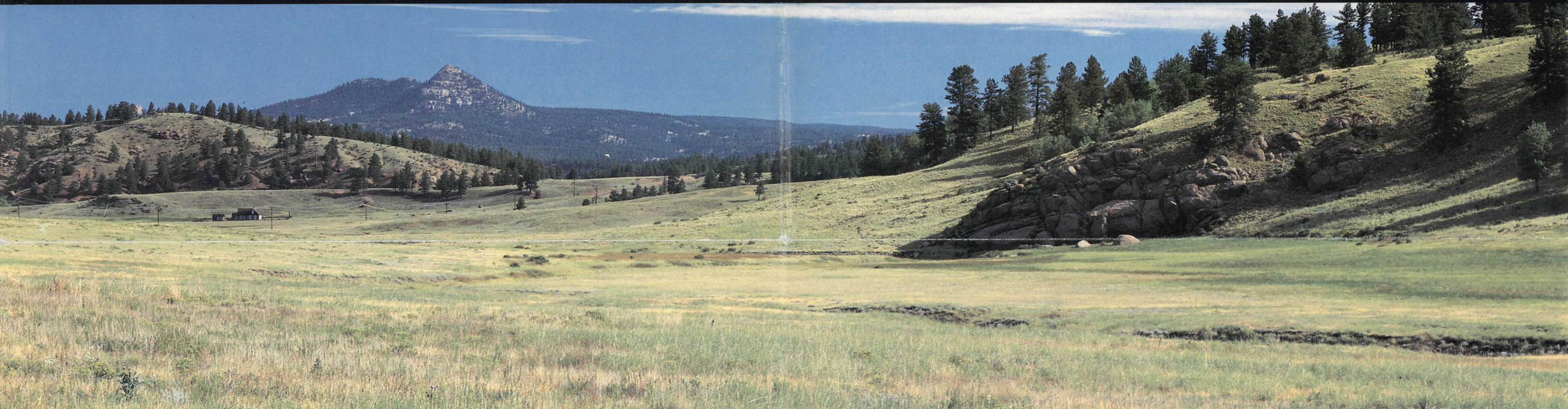


Florissant Fossil Beds

National Monument
Colorado

National Park Service
U.S. Department of the Interior

Official Map and Guide



Rich Buzzelli

Florissant Fossil Beds National Monument is a wonderland of meadows, forests, and wildflowers. Because of its great natural beauty an early settler from Florissant, Missouri named this area after his hometown. Its name means "flowering" in French. Yet 34 to 35 million years ago a description of this area would tell a very different story: Lake Florissant, stretching 12 miles through an ancient forested valley and averaging one mile wide, dominates the scene. Lush ferns and shrubs thrive beneath towering redwoods, cedars, pines, and a mixed-hardwood forest of maples, hickories, and oaks. In this warm, humid climate thousands upon thousands of insects crawl, fly, and buzz about. Fish, mollusks, birds, and mammals live in the lake or on its shores.

Nearby, a volcano rumbles. Earlier volcanic mudflows blanketed parts of the valley, burying redwood trunks and creating a dam that caused the lake to form. Now each time the volcano erupts again it showers the landscape with millions of tons of ash and pumice. Each rainfall washes this fine-grained ash into the lake. There it gently covers the remains of living things that have died and settled to the lake bottom. Insects, leaves, fish, and other fragments of life become buried in sediment made up of alternating layers of this eroded ash and the silica skeletons of single-celled algae called diatoms. Eventually these sediments become a finely layered shale and transform the buried plant and animal life into fossils.

Today Florissant Fossil Beds National Monument preserves this site. The fossil beds are internationally renowned for the variety and number of fossils—particularly of insects and plants—they have yielded since their discovery by scientists in the late 1800s. Paleontologists have collected more than 50,000 specimens for museums and universities around the world. These fossils reveal, in remarkable detail, what life of so long ago was like. Even a fragile and tiny butterfly may be preserved as a fossil showing clearly its antennae, legs, hairs, and the pattern in its wings. Massive petrified redwood stumps show that the ancient ecosystem had its giants, too. Yet little remains of other life from the ancient Lake Florissant valley. Fossil bones, teeth, shells, and feather im-

pressions reveal the existence of mollusks, fish, birds, mesohippus (an ancestor of the modern horse), brontothere (a large herbivore), and oreodonts (extinct sheep-like animals). But unless a mammal or bird died in or near the lake, its chances of preservation were very slim indeed. Future scientific explorations promise to unearth more of Florissant's buried treasures.

Fossils of Ancient Lake Florissant

Fossil photographs are not in relative scale.

Beech-like leaf
Fagopsis longifolia

Pine cone *Pinus*

Sequoia cones *Sequoia affinis*
Dennis Henry

Petrified sequoia stumps *Sequoia affinis*
Dennis Henry

Butterfly *Prodryas persephone*

Wasp
Paleovespa florissantentia

Caterpillar *Phylledestes vorax*

Wolf spider *Lycosidae*

The rich deposits from Florissant Fossil Beds give an unusually detailed look at life in ancient North America. These remains of prehistoric animals and plants are relatively young in geologic terms. Florissant fossils tell us much about what life was like 34 to 35 million years ago during the late Eocene Epoch, about 30 million years after the dinosaurs and 33 million years before humans appeared. Most Florissant fossils are kept and studied at various museums and universities.

A few are displayed in the park visitor center and at a few of these museums. Sadly, others were taken as souvenirs over the years, and what valuable information they might have provided cannot be known. Each fossil is an irreplaceable piece in the puzzle of the past. Fortunately, the park now protects millions of yet undisturbed fossils and studies a limited number excavated each year.

Fossil Plants Fossils of a diverse mix of more than 140 species of plants have been discovered at Florissant. Fossil leaves are most commonly found, but twigs, seeds, cones, flowers, and pollen grains also occur. These plant parts are preserved as detailed impressions or compressions, darkly colored by a thin residue of organic matter—all that remains of the original living thing. A very different type of plant fossil consists of massive petrified stumps of redwoods trees. They

stand now where volcanic mudflows buried them millions of years ago. The stumps turned to stone as minerals seeped in and gradually crystallized within the woody tissue. The fossil record suggests that the ancient forest was unlike any now in Colorado. Trees and shrubs grew in it whose closest living relatives are today found in widely scattered places such as the southeastern United States, Mexico, and China.

Fossil Insects Insects are rarely preserved as fossils because they are so fragile. The volcanic ash that washed into Lake Florissant was finer than talcum powder, however, and ideal for this delicate preservation job. Thousands of insect fossils have been recovered from the fine-grained shales. An amazing number of species—more than 1,400—have been described. Just as plants are, insects are usually preserved as detailed impressions or compressions in the shale. Some in-

sects look perfect, others are crushed, and some are just parts: a delicate wing, a headless body. Fossils also reveal evolutionary relationships: some leaves here show that insects fed on them. The fossils show that insects from 34 to 35 million years ago were much like those today. However, many types of insects which once lived at Lake Florissant no longer live in Colorado. And some, such as the tsetse fly, no longer live in North America. Others are extinct.

The Park Today

Mountain meadows and forested, rolling hills of ponderosa pine, spruce, fir, and aspen define the park landscape today. Petrified stumps of giant sequoias are the most visible remnants of the ancient ecosystem. Delicate remains of other late-Eocene flora and fauna, layered in the gray shales, show at the surface in a few locations.

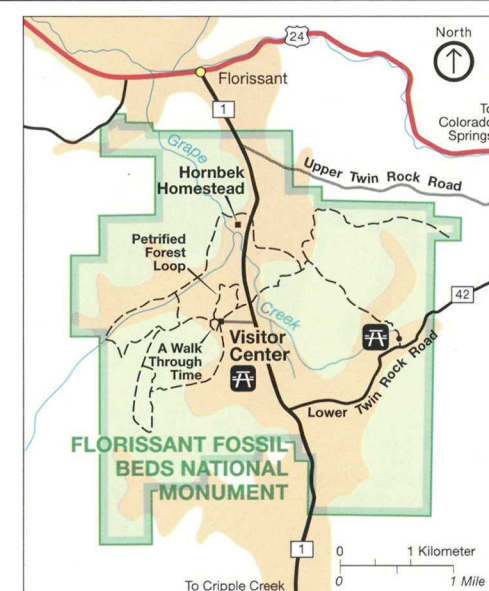
Fossils are best seen in the visitor center and on two short interpretive trails. Wildlife abounds, and wildflowers flourish in the short summer. Elk, black bear, coyote, badger, porcupine, mountain lion, and the tassel-eared Abert's squirrel are sometimes seen, as are resident golden eagles and red-tailed hawks. For hiking and photography, try the 14 miles of trails.

What to See and Do

Visitor Center The visitor center is a museum and information center open daily except Thanksgiving, Christmas, and New Year's day. Exhibits tell the story of how the fossils formed. Books, videos, other educational gifts, and hiking guides and interpretive brochures are available.

Schedules of ranger programs and guided hikes are posted. Junior Ranger activities and mini-seminars about the area are offered on weekends in summer. Several trails are near the visitor center. A shaded picnic area is close by, too. For more information con-

- Picnic area
- Unpaved road
- Hiking trail
- Ancient Lake Florissant



Hornbek homestead
tact: Superintendent, Florissant Fossil Beds National Monument, P.O. Box 185, Florissant, CO 80816-0185; 719-748-3253; or www.nps.gov/flfo.

Trails The park has more than 14 miles of trails. On **A Walk through Time**, a ½-mile loop trail, you can see fossil-bearing shales and petrified stumps. The one-mile **Petrified Forest Loop** also leads to the

shales and several petrified stumps, including the Big Stump, 38 feet in circumference. Both trails are wheelchair accessible. Other trails explore park forests and meadows and feature views of Pikes Peak. Ask for a trail brochure.

The Hornbek Homestead The 1878 Hornbek Homestead recalls the life of the early pioneers. Gold drew some to the area, but Ade-

line Hornbek and her children—and many other people, too—came here to farm and ranch. The historic site includes the original cabin and root cellar and three outbuildings moved here from other historic ranches.

Other Activities An environmental education program and field seminars help all ages learn about the area. On crosscountry skis or snowshoes is a great way to tour the park in winter. Ask a ranger for more information.

Nearby Services The town of Florissant offers restaurants, gasoline, and convenience stores two miles north of the park. Woodland Park and Colorado Springs, 15 and 30 miles east, respectively, offer complete travel services. Public and private campgrounds are nearby.

To Protect and Preserve

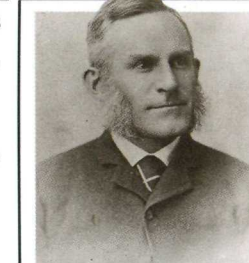
For 50 years scientists and other concerned citizens campaigned to create a park to protect the fossil beds from souvenir hunters and real estate development. Finally, in 1969, the national monument was established. As a paleontologist said, "an irreplaceable loss" was prevented. Florissant Fossil Beds National Monument is part of the National Park System, one of more than 370 parks that are important examples of our nation's natural and cultural heritage.

Please help protect our national heritage. **Do not collect or damage any fossil or other natural or historical resource.** • Build fires only in the grates provided in the picnic area. • Keep your vehicle on roadways. • Take pets in the designated exercise area only.

• Ride horses off-trail only, away from the visitor-use areas • Hunting, camping, and mountain biking are prohibited in the park.

For Your Safety Ticks can carry Rocky Mountain spotted fever and other diseases. Flea bites can transmit bubonic plague. Protect yourself from tick and flea bites. Rodents may carry hantavirus; do not contact them or their droppings. • Do not feed park animals. • Keep an eye on the sky; if a thunderstorm should threaten, get inside before the lightning strikes. • The altitude here is 8,500 feet, so pace yourself. • In winter dress in warm layers to keep dry and to prevent hypothermia.

Collections Near and Far



Samuel Scudder
Museum of Comparative Zoology, Harvard University

Since finding out about Florissant Fossil Beds in 1873, paleontologists have come to these rolling hills and open meadows to collect fossils. More than 20 museums and universities in the United States and United Kingdom house these specimens today. One of the largest collections is

at Harvard University's Museum of Comparative Zoology. Its 8,000 fossil insects were discovered by one of Florissant's first and most famous paleontologists, Samuel Scudder (left).

In the late 1800s his contemporaries were searching for and squabbling over bones of dinosaurs and prehistoric mammals. But Scudder led expeditions to the Florissant deposits. He collected all types of fossils, but the insects were his specialty. He painstakingly identified and described thousands. Professors T.D.A. Cockerell, of the University of Colorado at Boulder, and Harry MacGinitie, of the University of California at Berkeley, later retrieved and studied hundreds more insect and plant fossils. Institutions housing

Florissant fossils include: Denver Museum of Natural History, the Smithsonian Institution's National Museum of Natural History, American Museum of Natural History, University of London, Yale Peabody Museum, University of California Museum of Paleontology, and University of Colorado Museum.

Florissant Fossil Beds National Monument has now inventoried and photographed more than 5,000 of the most significant fossils at these museums to compile a database and create a virtual museum on the Internet. © GPO: 1999-454-767/00071 Reprint 1999 Printed on recycled paper.

The Age of Mammals

Life in the Cenozoic Era — the Last 65 Million Years

From simple beginnings great numbers and varieties of life forms have evolved and populated the Earth. For 140 million years before the Cenozoic Era, dinosaurs held dominion over the land. Mammals also existed, but they were small and not abundant. As the dinosaurs perished the mammals took center stage. Even as mammals increased in numbers and diversity, so did birds, reptiles, fish, insects, trees, grasses, and other life forms. The fossil record gives us a fascinating glimpse into the Cenozoic Era. Without fossils we would have little way of knowing that ancient animals and plants were different from today's. With fossils we discover that an extraordinary procession of organisms 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.

Other species migrated or became extinct. The fossil record tells these stories, but the study of fossil remains, paleontology, also raises many questions: What types of environments did these plants and animals live in? How did they adapt to climatic changes? How did different groups of plants and animals interrelate? How have they changed through time?

Fossils are studied in the context in which they were found and as one element in a community of organisms. Every fossil can serve as a key to unlock knowledge, so the National Park Service is especially concerned with the protection of these keys as the questions unfold. The Cenozoic Era continues today—see the right side of the chart below—and scientists estimate that as many as 30 million species of animals and

plants now inhabit the Earth. This is a mere fraction of all life forms that have ever existed. Scientists now think that about 100 species will become extinct every day, a rate accelerated by human actions. Pollution of the air and water; destruction of forests, grasslands, and other ecosystems; and other adverse changes to Earth's environment challenge life's very ability to survive. "Looking back on the long panorama of Cenozoic life," Finnish scientist Björn Kurten has said, "I think we ought to sense the richness and beauty of life that is possible on this Earth of ours." It is no longer enough to plan for the next generation or two, Kurten suggests. We should plan "for the geological time that is ahead. . . . It may stretch as far into the future as time behind us extends into the past."

These national parks (NP) and national monuments (NM) feature fossils from the Cenozoic Era: **Agate Fossil Beds NM**, 301 River Road, Harrison NE 69346-2734; **Badlands NP**, P.O. Box 6, Interior, SD 57750-9700; **Florissant Fossil Beds NM**, P.O. Box 185, Florissant, CO 80816-0185; **Fossil Butte NM**, P.O. Box 592, Kemmerer, WY 83101-0592; **Hagerman Fossil Beds NM**, P.O. Box 570, Hagerman, ID 83332-0570; and **John Day Fossil Beds NM**, HCR 82 Box 126, Kimberly, OR 97848-9701.



The North American Scene

Paleocene

Began 65 million years ago

The Paleocene Epoch began after dinosaurs became extinct. Mammals that had lived in their shadows for millions of years eventually evolved into a vast number of different forms to fill these newly vacated environmental niches. Many forms of these early mammals would soon become extinct. Others would survive to evolve into other forms.

The variety of other animals and plants also increased, and species became more specialized. Although dinosaurs were gone, birds continued to flourish, and reptiles lived on as turtles, crocodiles, lizards, and snakes.

As the Paleocene began, most mammals were tiny, like this rodent-like **multituberculata**. With time mammals grew in size, number, and diversity.



Palm trees and crocodilians thrived in the subtropical forests of the Paleocene and much of the Eocene.

Fossil Butte NM

Eocene

Began 55 million years ago

In the Eocene Epoch mammals emerged as the dominant land animals. They also took to the air and the sea. The increasing diversity of mammals begun in the Paleocene continued at a rapid pace in the Eocene. The many variations included some of the earliest giant mam-

Many freshwater fish lived in North American lakes during the Eocene Epoch. **Gars** (bottom), **herring** (middle), and **sunfish** (top)



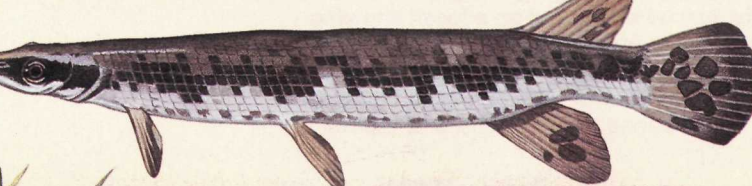
The variety of flowering plants exploded just before, during, and after the Eocene. They would populate the land with all sorts of new species of trees, shrubs, and smaller plants. **Cattails** grew in the shallows of Eocene freshwater lake edges.

Fossil Butte NM

mals. Some were successful, some not. The fossil record reveals many mammals quite unlike anything seen today. Increasingly, however, there were forest plants, freshwater fish, and insects much like those seen today.

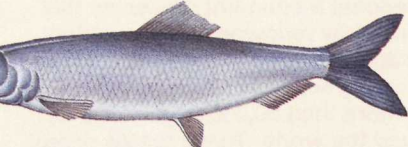
are similar in appearance to those Eocene fish.

Fossil Butte NM



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



Groves of giant redwood trees once grew throughout western North America. Changes in climate were responsible for these trees' shrinking range.

Florissant Fossil Beds NM

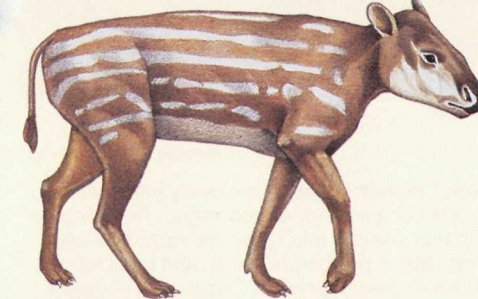
Delicate bones of shorebirds, including **frigate birds**, are preserved in the fine grained sediment of Eocene lake deposits.

Fossil Butte NM



Butterflies and many other insect groups co-evolved throughout the Cenozoic with the increasing variety of flowering plants. These insects became important agents of pollination.

Florissant Fossil Beds NM



Ancient tapirs such as **Heptodon** browsed near the shores of Fossil Lake in what is now western



Wyoming. Unlike modern tapirs, **Heptodon** had a very small snout.

Fossil Butte NM

Living in Eocene forests, the first **horse-like** animals were barely bigger than today's domestic cat. Throughout the Cenozoic Era their size increased. Their legs became longer,

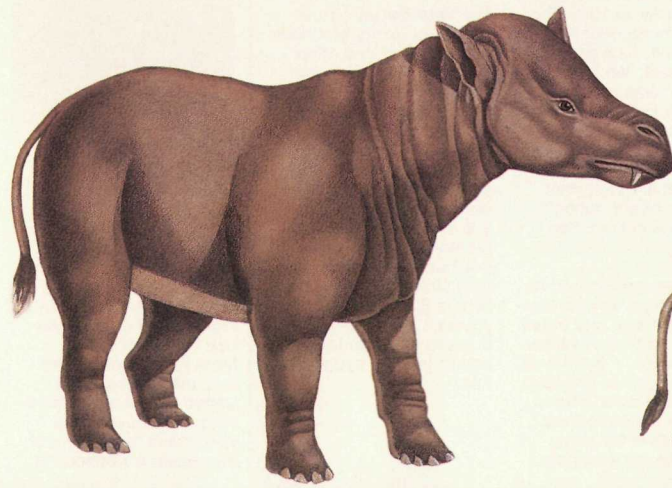
and their feet changed from many-toed to single-hoofed, for faster running. Their teeth evolved from being adapted for browsing to being adapted for grazing. Just a few of the species in the evolutionary



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

Florissant Fossil Beds NM

history of horses are shown here in silhouette across this chart. Fossil horses occur at many sites in the National Park System.



Coryphodon had short, stocky limbs and five-toed, hoofed feet, closely resembling the tapir. Its brain was very small. The males had large tusks. **Coryphodon** also lived on land not far from the shores of Fossil Lake.

Fossil Butte NM

Oligocene

Began 34 million years ago

The Oligocene Epoch was a time of transition between the earlier and later Cenozoic Era. The once warm and moist climate became cooler and drier. Subtropical forests gave way to more temperate forests.

Late in the Oligocene, savannas—grasslands broken by scattered woodlands—appeared. These changes caused mammals, insects, and other animals to keep trending 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.



Ekgmowechashala marked the end of the original primate lineage in North America. A small lemur-like primate, it may have used large skin folds to glide from tree to tree. Its name means "little cat man" in Lakota, which the discoverer understood to be their name for monkey.

John Day Fossil Beds NM



Oreodonts, a group of sheep-like animals, were successful in the Eocene and Oligocene. By the end of the Miocene they had completely died out.

Badlands NP

Miocene

Began 23 million years ago

The abundance of mammals peaked in the Miocene Epoch. The refinement in life forms that marked this epoch saw many animals and plants develop features recognizable in some species today. The forests and savannas persisted in

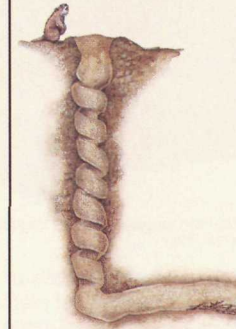


Moropus was a distant relative of the horse and one of the more puzzling mammals. For many years paleontologists thought its feet had claws rather than hooves.

Agate Fossil Beds NM

Lacking other defenses, some larger rodents, such as the dry-land beaver **Palaocastor**, lived in colonies beneath the High Plains of North America. Their burrows remain as trace fossils today.

Agate Fossil Beds NM



Rhinos were varied and abundant during most of the Cenozoic Era. Around the world they ranged in size from the three-foot-tall North American spe-

cies **Menoceras** (shown here) to a giant Asian species, the largest land mammal yet found in the fossil record.

Agate Fossil Beds NM



Daphnoedon was carnivorous. It differed from the earliest true dogs of the Oligocene Epoch. Its

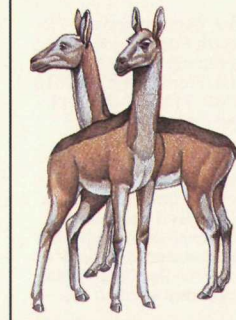
so-called "beardog" family eventually went extinct.

Agate Fossil Beds NM



Daeodon (formerly called **Dinohyus**, "terrible hog") had bone-crushing teeth enabling it to scavenge the remains of other grassland animals.

Agate Fossil Beds NM



The tiny gazelle-camel **Stenomyiulus** probably grazed in herds for protection from predators.

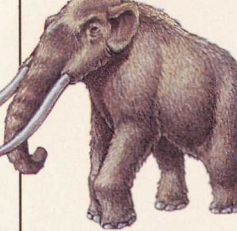
Agate Fossil Beds NM

Pliocene

Began 5 million years ago

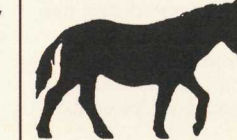
Most life forms of the Pliocene Epoch would have been recognizable to us today. Many individual species were different, but distinguishing characteristics of various animal and plant groups were present. Evidence of wet meadows and of dry, open grassland environments has been found in the Pliocene. Toward the end of this epoch 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.

Mammut was a type of mastodon that migrated to North America in the Pliocene. In the early Pleisto-



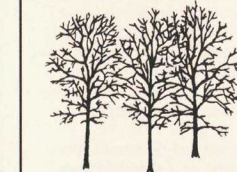
cene another elephant group called mammoths joined the mastodons. By the late Pleistocene mastodons and mammoths both became extinct, possibly because of climatic changes or hunting by early people.

Hagerman Fossil Beds NM



Willow, alder, birch, and elm grew on the ancient river plains of the Pliocene. These same plants grow along streams and rivers today.

Hagerman Fossil Beds NM



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

Hagerman Fossil Beds NM



Pleistocene

Began 2 million years ago

The Pleistocene Epoch began with widespread migrations of mammals and ended with massive extinctions. It was also a time when glaciers repeatedly covered much of North America.

Known evidence of humans living in North America dates to about 12,000 years ago. In this relatively brief period we have had a profound effect on the plants and other animals here. Do we have a responsibility to try to limit our effects on other species, or are humans simply a natural agent of extinction?



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 agencies and private organizations entrusted with helping to protect endangered plants and animals and to preserve the diversity of life throughout North America.



This illustration by John Dawson. All other full-color illustrations by Karen Barnes. Some depictions of mammal species follow fossil reconstructions as represented 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.

