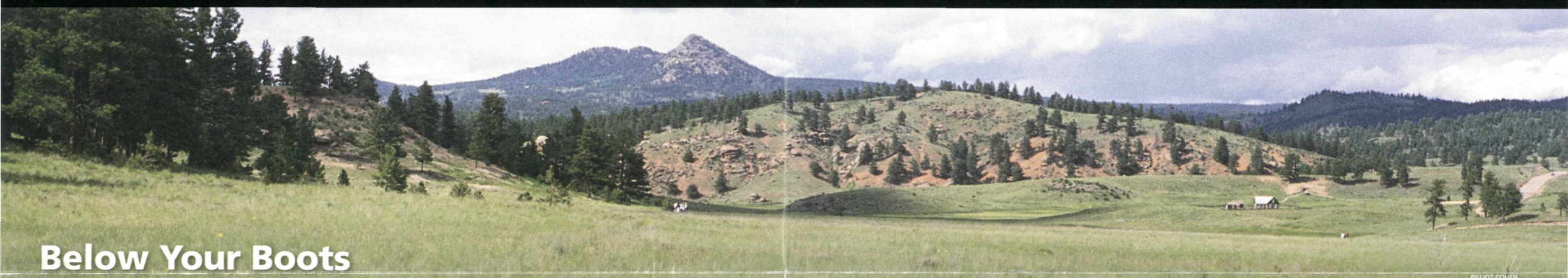
Florissant Fossil Beds

Florissant Fossil Beds
National Monument
Colorado

National Park Service
U.S. Department of the Interior



©ELIOT COHEN

Below Your Boots
THE PAST IS PRESENT

Palæovespa was an ancient wasp. Its form has changed little in 34 million years! You'd recognize its relative at a picnic today.

Fossil insect sites are far more rare than fossil plant sites—which only adds to the global significance of the Florissant Fossil Beds.

Palæovespa
NPS

To leave a record of our experience is a very human desire. Early humans painted cave walls and etched in rock the events of their lives. In Colorado some of these historic stories in stone date back 4,000 years. But the picture-perfect wasp *(left)* records events even 10,000 times older than that. Here, beneath pine covered hills and grassy meadows in south central Colorado, lies one of the world's richest fossil deposits. Remnants of an ancient world lie just below your boots.

Florissant Fossil Beds National Monument has yielded over 50,000 museum specimens from fossils of over 1,700 species—1,500 insects, 150 plants, and one of the world's only known fossil records of the tsetse fly, now found only in equatorial Africa. Here, no big bones stick out of the ground, but delicate fossil insect wings and finely veined leaves lurk beneath your feet, deep time's secrets locked in paper-thin shale. This world-class snapshot records Eocene Epoch life here 34 million years ago (mya).

WHAT WAS THE EOCENE? Keep in mind: here didn't look like *here* 34 mya, and what *was* here was vastly different. Redwood trees in Colorado, you ask? Similar redwoods now grow only in a thin belt on the California and Oregon coasts but exist here as fossil stumps, many still beneath the valley floor. No doubt the tsetse fly thrived because *here* was warm-temperate then, not today's cool-temperate highlands. In the Eocene Epoch—55 mya to 33.8 mya *(top globe below)*—warm-temperate forest reached the Arctic. And these fossil plant communities are much like today's plant communities in northeast Mexico, southern Texas, southern Appalachia, and eastern Asia. They represent the end of the Eocene *(timescale below)*, with global climate set to cool dramatically over millions of years. For planetary life this would be the biggest event since the extinction of dinosaurs 65 mya.

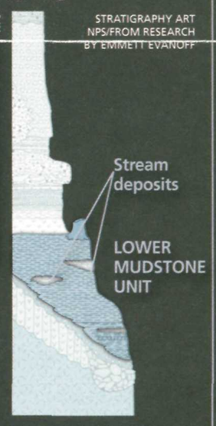
STRATIGRAPHY In 1669 the Danish geologist Nicholas Steno described how younger rock layers—strata—usually lie over older rock layers. Stratigraphy is the study of rock layers and layering and can show sequences of events like volcanoes or how lakes come and go over time. Three diagrams below show these fossil-bearing layers, which vary by how their rock was formed. Shale formed from very fine volcanic ash and diatoms (microscopic algae) settling to a lake bottom, which cemented our wasp's great legacy.

CENOZOIC ERA
PALEOCENE *61 mya* | EOCENE *49 mya* | *34.07 mya* | OLIGOCENE *28.5 mya* | MIOCENE *16.4 mya* | PLIOCENE *3.6mya* | PLEISTOCENE *.8 mya* | HOLOCENE *present*
FLORISSANT FOSSIL BEDS

Mudflows and Streams of Stone

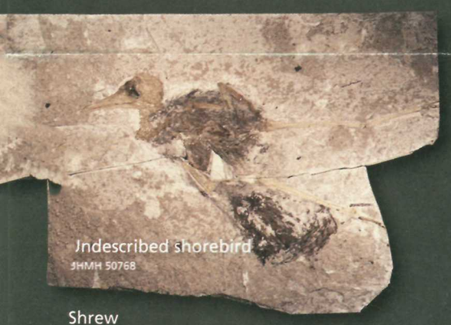
NPS

A massive volcanic area—the Guffey Volcanic complex—existed 15 miles to the southwest 34 mya. The eruptions mixed ash, water, and possibly snow to create massive mudflows called lahars. They covered today's Florissant. The volcanic sediments broke down to soil, in which forests grew. Streams flowed in the forests. Mammals of the forest died near the streams, became buried in stream deposits, and were fossilized. The stream deposits were covered by more mudflows.



STRATIGRAPHY ART NPS/FROM RESEARCH BY EMMETT EVANOFF

FLORISSANT ROCK LAYERS
Volcanic mudflows and stream deposits make up the lower mudstone unit. Mammal fossils are found in stream deposits.



Indescribed shorebird
SMHM 50768

Shrew
Domnina thompsoni
MARIE WORLEY-GEORG

What ancient mammal's jaw might fit on a straight pin? A shrew's. Its teeth say "meat eater," or at least "tearing" as opposed to "grazing."

From a nearby private fossil site, this bird is from a shale layer *below* the lower mudstone unit.

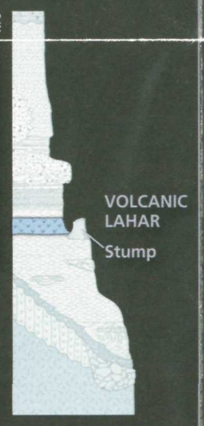
Lower jaw of primitive horse *Mesohippus*
UCM 65951

About the size of a collie, *Mesohippus* had three toes, not hooves. Its front teeth stripped plants.

Volcanic Lahar Layer

NPS

Powerful, destructive, *and* creative, lahars are mud flows from the slopes of volcanoes. They can move 150 mph down the slopes and carry car-sized boulders. A lahar from the Guffey volcano *(above)* entombed ancient redwood trees in up to 15 feet of mud and volcanic debris. Eventually the parts of trees encased in mud would become petrified *(below)*. A later Guffey lahar dammed a stream, creating Lake Florissant. In its bottom sediments many insect, leaf, and fish fossils began to form.



FLORISSANT ROCK LAYERS
The lahar was a volcanic mudflow. It buried an ancient redwood forest. The petrified stumps are found in this layer.

Fossil redwood cones and needles *(below)* are not from the volcanic lahar layer but from the paper-thin shale layers *(right)*.

Fossil redwood *(Sequoia affinis)* stump
©ELIOT COHEN

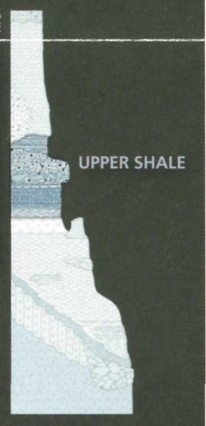
How many redwoods were petrified here? We don't know. Collectors took remnants of many over 100 years ago. The redwood grove lived in the valley bottom. Dissolved silica in the groundwater petrified the trees. This one was over 12 feet in diameter. Some hardwoods were petrified, too.

Redwood cones and needles *(below)*
UCM 34188 CONES, NPS NEEDLES

And Paper-thin Shale

NPS

Fragile, paper-thin shale that formed on the bottom of Lake Florissant preserves delicate fossils. The shale formed from repeated microlayers of clay and volcanic ash—finer than talcum powder—overlain by films of the skeletons of dead diatoms. Sticky, surface mats of the dead algae trapped insects and leaves, then sank. The shale's delicate, fine-grained layers preserve tiny features in great detail. Many Florissant fossils look like realistic paintings or exquisite drawings.



FLORISSANT ROCK LAYERS
Many, many repeated layers of clay and ash and filmy mats of diatoms formed the thin shale creating intricate insect and leaf fossils.

Sucker fish
Amyzon
UCM 19344

Caterpillar
Phylledestes vorax
UCM 4608

Hydrangea blossom
Hydrangea fraxinifolia
COURTESY OF SMITHSONIAN INSTITUTION

Of Florissant's relatively few vertebrate fossils (having backbones), most are fish, and most are bottom-feeding fish *(above)*. Note the fossil's complex texture. It shows each part of the sucker's backbone.

Tsetse fly
Glossina oligocena
UCM 31594

EOCENE *Eos*=dawn + *ceno*=new: The Eocene Epoch (55 mya–33.8 mya) is named for the dawn of small mammals. The climate was warm, sea level high, oceans warmer than now, and continents on the move. Glaciers began to form in Antarctica. In the late Eocene, global climate was set to cool significantly.

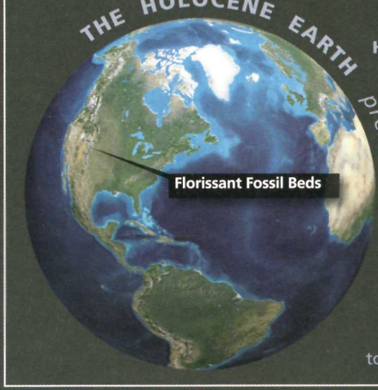
34 MYA
a different world

Florissant Fossil Beds may give clues about how an ecosystem responds to climate change. Soon after fossil beds formed here 34 mya, just as the Eocene gave way to the Oligocene Earth's climate cooled rapidly, by geologic measures.

CLIMATE CHANGE

Where relatives of fossil plants and insects now live may show response to changing climate. We can compare this fossil site to others formed after climate cooled. So, even something "as old as a fossil" can be relevant and full of information today.

MAPS ©RONALD C. BLAKEY, NAU GEOLOGY

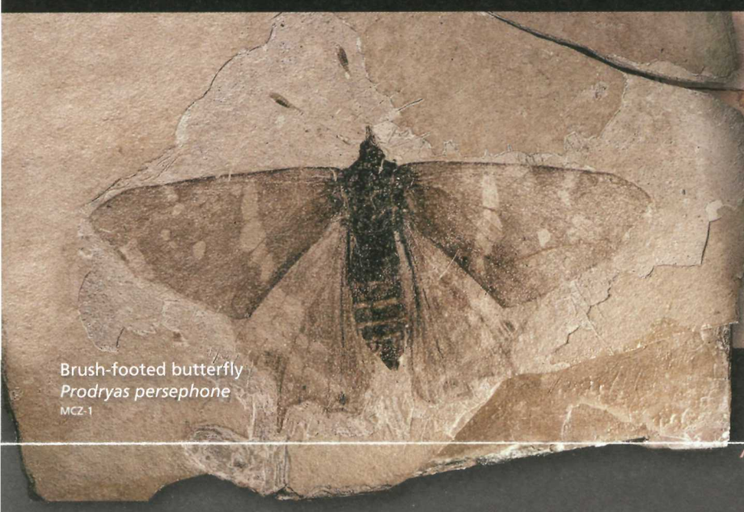


HOLOCENE *Holos*=entirely + *cene*=new: The Holocene Epoch is recent time, the last 10,000 years. An important thing these fossil beds can show us is how life adapted to the rapid climate change that took place soon after 34 mya. Compare: Eocene North and South America did not have a land bridge—today's Central America.

Florissant Fossil Beds date to 34 mya

Think of the history of the Earth as though it were the width of this brochure. At such a scale, humans have inhabited the planet for less time than the ***thickness*** of the paper.

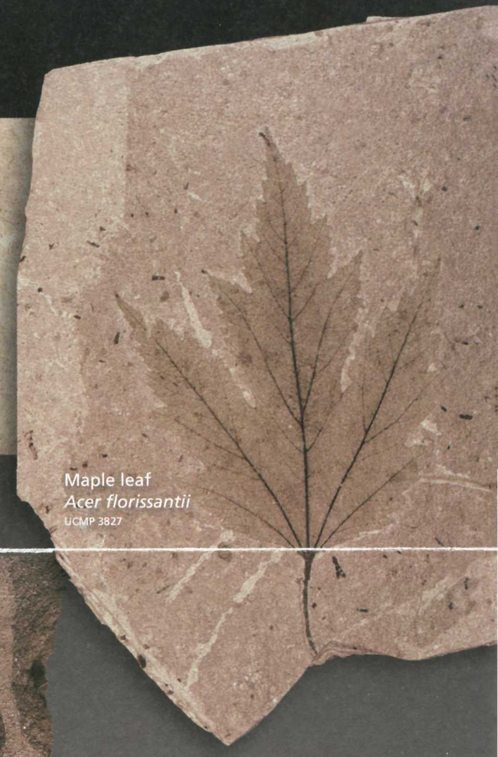
Stone Secrets of Deep Time



Brush-footed butterfly
Prodryas persephone
MCZ-1

Damselfly
Miopodagrion optimum
UCM 8609

Flower calyx
Florissantia speirii
UCMP 3619



Maple leaf
Acer florissantii
UCMP 3827

Birch-like leaf
Paracarpinus fraterna
UCMP 198423

Snout beetle
Curculio restrictus
AMNH-FL-39435A

CREDITS KEY
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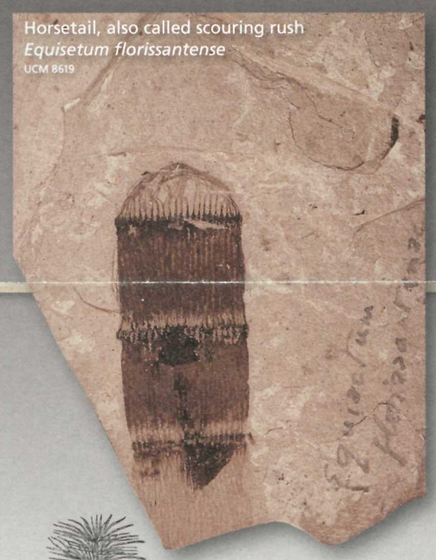
"We get all tangled up with the present. . . .

Humans are curious, exploring outer space, ocean depths, and even our own genes. Untold discoveries remain here at Florissant. Beneath this valley and rolling hills lies an ancient world, a 34-million-year-old ecosystem. Remarkably, scientists can describe the ecosystem in detail—despite such deep time—because so many of its working parts survive in stone. These fossils are not for burning for fuel. These fossils fuel our understanding and imagination. Their high biotic diversity tells of a warm-temperate past in a place that is now cool-temperate. They show organisms whose relatives still live here. They show others that no longer exist. Still others now exist only in other parts of the world. Tsetse flies fossilized here but don't live in North America. They live in equatorial Africa. Some secrets do remain: No fossils of reptiles or amphibians have been found here. Discovery goes on and on, with an active paleontology program.

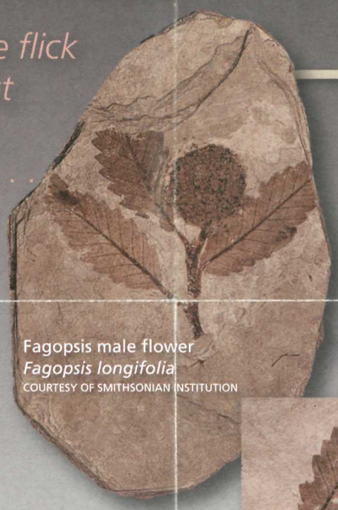
The present is just a little flick in time between the past and the future. Things keep going on and on. . . .



Horsetail, also called scouring rush
Equisetum florissantense
UCM 8619

Cattail leaf
Typha lesquereuxi
UCMP 3645

Oak acorn
Quercus
WC-FL-6



Fagopsis male flower
Fagopsis longifolia
COURTESY OF SMITHSONIAN INSTITUTION

THE BEECH FAMILY

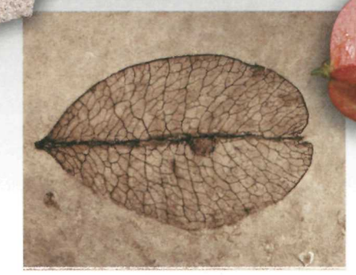
Broadleaf plants, not conifers, were most diverse here 34 mya. A now-extinct member of the beech family, *Fagopsis longifolia*, was common. Its fossils have different plant organs attached, showing stages of the tree's reproductive cycle. This is very unusual and therefore significant. No fossils of its wood have been found with organs attached, so its wood is a mystery.

Fagopsis fruiting head
COURTESY OF SMITHSONIAN INSTITUTION

Fagopsis fruit wedges
COURTESY OF SMITHSONIAN INSTITUTION

Compare this 1800s engraving of modern beech tree parts *(left)* to the fossilized parts.

Fagopsis female flower
Fagopsis longifolia
YPM-30121



Golden rain tree fossil, *Koelreuteria allenii,* with modern fruit *(above).*
UCM 34187 FOSSIL; FRUIT © DAVID LIEBMAN

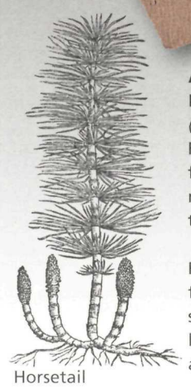
Millipede
Parajulus cockerelli
AMNH-FL-22564

Female wolf spider
Lycosa florissanti
AMNH-FL-19032A

A VARIED ENVIRONMENT

Fossilized horsetails *(left)* and cattails *(right)* probably grew near ancient Lake Florissant or near streams. By contrast, fossil oak tree leaves show that hillsides may have been comparatively drier—as they are today.

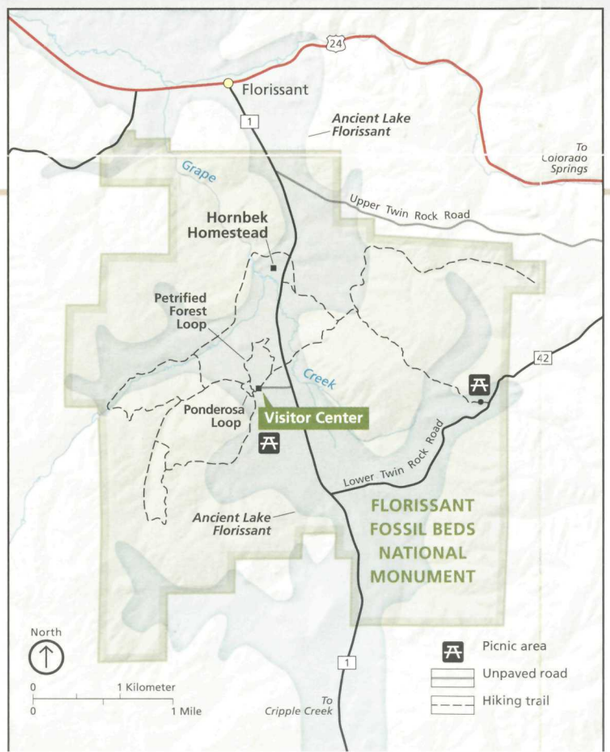
Fir pollen suggests that cooler conifer forests may have existed on the upper slopes of the nearby volcano. The biologically diverse fossils show that the ancient environment was diverse.



Horsetail

Cattail

We are just in this particular little time interval, and it seems so important to us."
— Harry D. MacGinitie, 1979



ANOTHER CONTINENT

Like the tsetse fly, the golden rain tree *(right)* no longer lives on the North American continent. It now lives only in eastern Asia—providing a clue to how plants dispersed in the past.

ENJOYING THE NATIONAL MONUMENT TODAY

Today's park landscape features mountain meadows and rolling hills forested with ponderosa pine, spruce, fir, and aspen. These trees stand in stark contrast to petrified giant sequoia stumps from the ancient ecosystem these fossil beds preserve. And those petrified stumps stand in massive contrast to the delicate insect and leaf fossils.

It took 50 years of advocacy by many scientists and other people to get the fossil beds protected in 1969, in order to prevent irreplaceable loss. You can help protect this precious national heritage. **Do not collect or damage the fossils, petrified wood, or other natural or historical features.** And please report any violations you see to a park ranger.

Fossils from Florissant are in over 20 U.S. and U.K. museums and universities. Harvard University houses 8,000 fossil insects that paleontologist Samuel Scudder found in the late 1800s. T.D.A. Cockerell of the University of Colorado, Boulder, and Harry MacGinitie, of the University of California, Berkeley, later studied fossils here.

Park staff inventoried and photographed over 5,000 significant fossils at 17 museums to create a virtual museum and research database. To explore it go to www.nps.gov/flfo.

Fossils are best seen here in the visitor center, in the outdoor exhibit area behind the visitor center, or on the one-mile Petrified Forest Loop. Get out on the park's 14 miles of trails (get a trail brochure at the visitor center). You may see an elk, black bear, coyote, badger, porcupine, tassel-eared Abert's squirrel, golden eagle, red-tailed hawk, or mountain lion. The altitude is 8,500 feet above sea level, so pace yourself, drink lots of water, and use sunscreen.

The wheelchair-accessible **Ponderosa Loop** starts behind the visitor center outdoor exhibit area. This half-mile walk goes through montane forest. On the one-mile **Petrified Forest Loop** you can see a fossil excavation site, the Big Stump (38 feet in circumference), and other massive stumps.

Schedules of ranger programs and hikes are posted in the visitor center, open daily except Thanksgiving, December 25, and January 1. Exhibits there show how fossils form. Find out more in books, videos, DVDs, and other items sold there. Also check on educational programs, field seminars, and the Junior Ranger program.

The 1878 **Hornbek Homestead** *(can you find it in the top photo on the other side?)* recalls pioneer life. Adeline Hornbek and her children farmed and ranched here. See their original cabin and root cellar and three historic buildings moved here from local ranches.

Services are available two miles north of the park in the town of Florissant: gasoline, restaurants, and convenience stores. Lodging is available in Woodland Park and Colorado Springs east of the park. Public and private campgrounds are nearby.

Indian Paintbrush
© JAMES M. ANDRE/CALPHOTOS

More Information
Florissant Fossil Beds National Monument
P.O. Box 185, Florissant, CO 80816
719-748-3253 or www.nps.gov/flfo
Emergencies: Call 911

Florissant Fossil Beds National Monument is one of over 390 parks in the National Park System. The National Park Service cares for special places saved by the American people so that all may experience our heritage. To learn more about parks and National Park Service programs in America's communities, visit www.nps.gov.

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