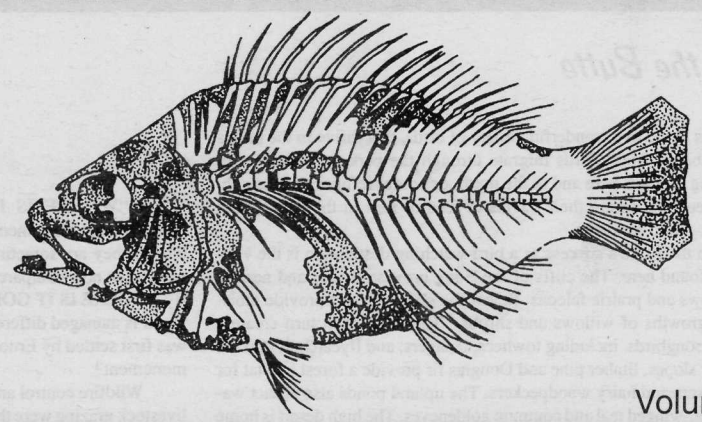
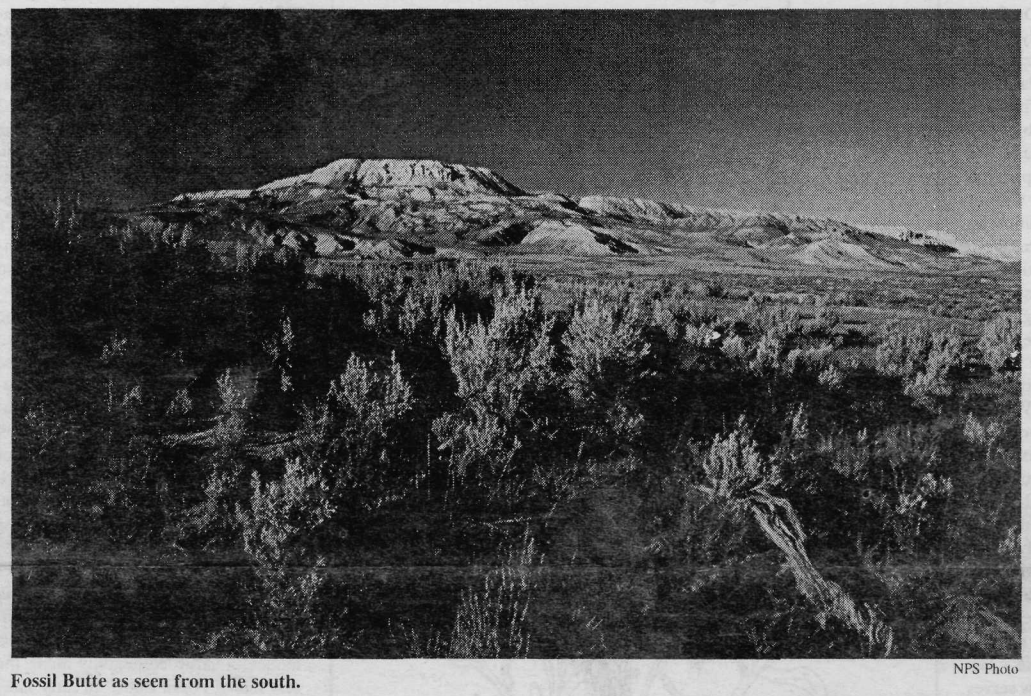
# Fossil Butte Shore Lines



Volume 1



Fossil Butte as seen from the south.

NPS Photo

## Welcome

Welcome to Fossil Butte National Monument. Hidden within the landscape before you lies one of the richest fossil deposits ever discovered. Representing an Early Eocene lake community, the fossils are world renowned for their diversity and remarkable preservation. Arriving annually from across the country and around the world, park visitors marvel at the delicate remains of flowers and insects, as well as larger creatures like crocodiles, birds, and mammals. Over 20 species of fossil fish have been discovered and millions of specimens can be found in collections and museums throughout the world.

The Monument also offers a variety of contemporary flora and fauna of the high desert. Among the rolling hills and valleys lie hidden springs and seeps providing for groves of willow, aspen, and pine. The resulting patchwork of vegetation is not only home to mule deer and pronghorn, but also to beaver, elk, and moose.

Fossil Butte National Monument is one of over 370 units managed by the National Park Service for your enjoyment. Please join us in our efforts to preserve and protect this special place by remembering not to collect or disturb any cultural or natural features. Each piece, past and present, adds invaluable knowledge and understanding to our world.■

## Meal Time

Baby alligators pull themselves out of the water onto lily pads to sun in the mid-day heat, snacking on crayfish and insects that reside around and under the plants. A large soft-shelled turtle swims nearby, munching on a small fish that swam too close. Off in the deeper waters, a crocodile makes a quick sideways movement, capturing a gar. A wading bird scours the shoreline for mollusks. Swarms of flies dine on a mat of decaying fish floating on the surface. A bat flutters through a tangle of vines with a beetle seized in its jaws. A snake, slithering among cattails, stalks a frog. A frigate-like bird glides overhead, then swoops down upon an unsuspecting lizard resting on a palm frond. Where are we? The Florida Everglades comes to mind, but this is Fossil Lake, 50 million years ago. Dinosaurs were long gone, extinct for almost 15 million years. The wet, warm climate was a lot like today's Florida Everglades; fish, plants, birds, insects, and mammals flourished. Fossil Lake spread for miles across western Wyoming, and was one of three lakes that made up the Green River Lake system. Fossil Lake was the smallest, covering some 932 square miles at its apex and also the deepest during much of its 2-million-year existence.

Today the lake has changed to a cool mountain desert, and its ancient tropical environment has been preserved in the form of millions of fossils. Although evolution has changed most of these creatures in countless ways, many of the fossil plants and animals would look familiar because their relatives survive today. By far the most common fossils from Fossil Lake are fishes. Among the most extraordinary marvels are the mass mortality layers which preserve as many as several hundred fish per square meter. Union Pacific Railroad workers first discovered fossil fish over 100 years ago. Scientists along with commercial and amateur collectors still quarry thousands from the fossil-rich limestone each year. All of the animals introduced above have been discovered in Fossil Lake sediments.■ *by Kris Thompson*

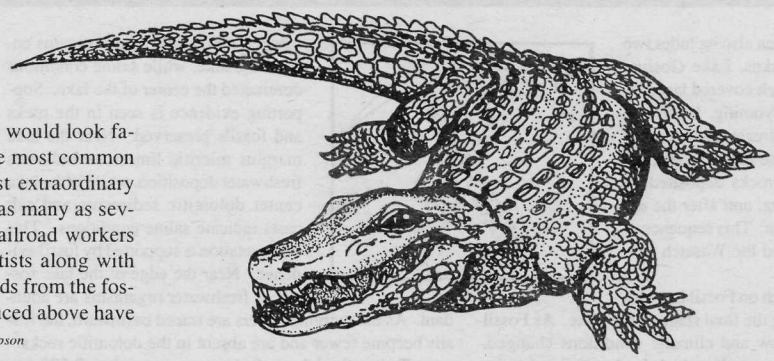


Illustration by Shawn Duffy

## Suggested Activities

June-August 8:00 am-5:00 pm

***VISITOR CENTER:*** **Open daily during the summer from 8:00 am to 7:00 pm; and during the winter from 8:00 am to 4:30 pm (closed during winter holidays). Displays an excellent collection of fossil flora and fauna from an Early Eocene lake community. Short videos highlight excavation and interpretation of the fossils, and staff are available to answer questions. Several kinds of interpretive programs are offered during the summer.**

***LEISURE DRIVE:*** **A short drive takes you past different views of Fossil Butte and the surrounding basin. Wayside exhibits interpret local flora and fauna both of today and 50 million years ago. North of the picnic area, the road changes to gravel and leads to public lands outside the Monument (roads beyond the visitor center are closed in winter, and gravel roads are impassable when wet).**

***TAKE A HIKE:*** **1 ½ and 2 ½-mile loop trails take you through aspen groves, past hidden springs and a beaver pond, or up the flank of Fossil Butte to a historic quarry where many world-renowned fossils were excavated. Cross-country hiking provides opportunities for solitary exploration of a high desert, sagebrush steppe environment.**

## Table of Contents

## Birding the Butte

Fossil Butte is home to a wonderful variety of birds, that thrive in the park's different habitats. Many birds migrate through the park on their way to summer breeding grounds here and to the north, or winter refuges to the south. These birds often stop during their travels to feed or nest in the park. Other species are year-round residents.

The key to the Butte's success as a bird-watching destination is the variety of habitats found here. The cliffs of the Butte provide shelter and nesting areas for swallows and prairie falcons. Below the cliffs, springs provide moisture for dense growths of willows and shrubs. The thickets in turn create a home for many songbirds, including towhees, tanagers, and flycatchers. On the northern, cooler slopes, limber pine and Douglas fir provide a forest habitat for Clark's nutcrackers and hairy woodpeckers. The upland ponds also attract waterfowl like green-winged teal and common goldeneyes. The high desert is home to black billed magpies, rock wrens, and shrikes.

*One of the most exciting groups of seasonal visitors are the raptors.* Raptors migrate through the park in groups, pairs, or as individuals during April and September. While travelling they enjoy soaring on the warm winds rising off the sun-baked cliff faces of Fossil Butte. Red-tailed, Swainson's, and rough-legged hawks are the most common broad-winged hawks. Sightings of golden eagles are frequent, and bald eagles winter here. Kestrels and northern harriers (marsh hawks) are year-round residents, joined by prairie falcons in the summer.

Fossil Butte is also famous for its resident sage grouse. In fact, the central valley of the park is drained by Chicken Creek, named for the chicken-like grouse. These birds have an impressive spring mating ritual. Male grouse claim a small territory on the desert floor, where they construct a lek, or booming ground, a narrow path cleared of rocks and plant debris. Here he struts and booms using a hollow in his neck and chest, hoping to attract a mate. The population of grouse in the park put on a very noisy spring show.

Although there are birds here year-round, the best times to go birding at

***Male Sage Grouse Booming***

Illustration by Shawn Duffy

the Butte are in the spring, summer, and fall, at dusk and dawn when birds are most active. The migrations during spring and fall are also great times to see a variety of birds not present at other times of the year. Feel free to inquire at the visitor center if you see something you can't identify. A ranger should be able to help!■ *by Dave Hays*

# FOSSIL BUTTE VEGETATION

## WHERE IS IT AND WHERE IS IT GOING?

By "WHERE IS IT," we don't mean to imply that Fossil Butte National Monument lacks vegetation. Plants grow nearly everywhere, even though they are sometimes sparse. The question is: what is the status of the vegetation now compared to its status before it was affected by Eruoamericans? By "WHERE IS IT GOING," we inquire how will the vegetation change now that it is managed differently from the way it was between 1880, when the area was first settled by Eruoamericans, and 1972, when the area became a national monument?

Wildfire control and domestic livestock grazing were the two post-settlement practices that had the greatest impact on the vegetation of the Monument. In 1984, Dr. Robert Dorn, an expert on Wyoming vegetation, conducted a grazing impact study for the National Park Service. He determined that fire control may have caused sagebrush to increase, and grass to decrease, but that wildfire frequency appeared relatively unchanged from pre-settlement times. In addition, he said livestock grazing initiated these trends in the native vegetation: 1) the amount of perennial grasses and native forbs began declining, 2) the number of annual weeds began increasing, and 3) more bare ground began appearing. In 1990, livestock grazing was discontinued. We now believe past trends have reversed themselves, because grass now grows in what were well-worn cow trails. Fossil Butte National Monument is unique because it is the largest land unit (approximately 8,200 acres) in southwest Wyoming presently being managed to allow the native vegetation to achieve its full potential under conditions remaining as natural as practicable. The Monument's vegetation now serves as a standard for measuring change in regional native plant communities following the discontinuation of livestock grazing.

Presently, we limit direct management of the Monument's vegetation to reclamation activities and weed control. Four out of five dams have been removed. A number of abandoned roads, whose ruts persist, will be revegetated. Only native species are planted on reclaimed areas. We also control several species of exotic weeds, mostly by manual, rather than chemical, means. At present, the invasion of exotic weeds is probably the biggest threat to the Monument's native vegetation. Approximately 10% of the species on the Monument have been introduced, but many (Kentucky bluegrass and the common dandelion for example) are considered naturalized, and we do not attempt to control them. In 1998, Park Service personnel spent nearly 200 hours controlling exotic weeds, primarily Canada, musk, and bull thistles; perennial sowthistle; spotted knapweed; whitetop; and yellow sweetclover. State and county regulations require landowners to control several of these weeds, but not yellow sweetclover. Its invasive behavior, however, demonstrates why we control it and several other exotic plants.

Yellow sweetclover has invaded several acres of Monument land, especially in the vicinity of the Historic Quarry Trail parking lot. From late July through August, its yellow blooms radically alter the appearance of the natural landscape. This weed competes for space and soil moisture, and it adds nitrogen to the soil. It is also a prolific seed producer, whose seed remains viable for many years. Unless it can be controlled, it will likely spread and significantly alter the plant communities it invades by displacing native plants. The other weeds, previously mentioned, behave similarly.

Despite having been grazed (and overgrazed) by domestic livestock for more than a century, and having been invaded by exotic plants, many of the native plant communities of Fossil Butte National Monument are believed to be in relatively pristine condition. The vegetation is diverse; the Monument's plant list includes 550 species (including varieties) belonging to 66 families. We expect new species will be added to the list with continued research. Floral treasures abound among the Monument's 12 recognized plant community types. The remainder of this article is devoted to the discussion of our favorites. Remember, this is Fossil Butte National Monument. The flowers are for everyone's enjoyment, but it's important to remember they are protected by law, so ***PLEASE DO NOT PICK THEM.***

***High Desert Wild Flowers***

Illustration by Shawn Duffy

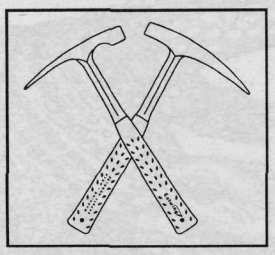
In late May and early June, the cushion plant community explodes into bloom. Once the blooms are gone, these dwarf, rounded plants are inconspicuous, and the windswept ridges they favor appear almost barren. Cushion plants are abundant near the summit of the east end of the Bull Pen and on windswept ridges throughout the Monument. Two popular cushion plants are stemless goldenweed (*Happlopappus acaulis*) and spoonleaf milkvetch (*Astragalus spatulatus*). Yellow fritillary (*Fritillaria pudica*), a lily, is another early bloomer. Look for it near melting snow in the mountain shrub community along the east side of Fossil Butte. In early June, its cousin, the leopard lily (*Fritillaria atropurpurea*), begins to bloom. Look for it in the mountain sagebrush community north of the road near the Monument's northern exit.

While hiking in early June, you can see another beauty, darkthroat shootingstar (*Dodecatheon pulchellum*), growing in open meadows near the Fossil Lake Trail. When you hike the trail later in June and early July, you will see the pink flowers of sticky geranium (*Geranium viscosissimum*) under aspen and among shrubby vegetation. A July favorite is the hooded coralroot (*Corallorrhiza striata*). You will have to look closely to find this inconspicuous orchid on the forest floor under dense aspen, but its small, pale, striped flowers, which otherwise resemble the orchids of floral shops, will reward your search. Hooded coralroot is saprophytic (meaning it obtains nutrients from decaying vegetation and therefore lacks chlorophyll). And last, but not least, look for blazing star (*Mentzelia laevicaulis*) along the steep, barren, rocky slopes of Cundick Ridge during mid-to-late summer. Rough to the touch, this coarse plant reaches several feet in height, but its large, yellow, spidery flowers are delicately beautiful. These are a few of the many treasures that await the flower enthusiast.■ *by Clayton Kyte*

## Lively Streams and Lazy Lakes

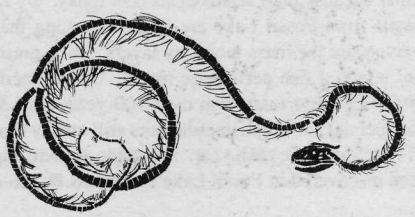
The rocks exposed within Fossil Butte National Monument tell a story about an ancient lake and river environment that existed in Fossil Basin. Fossil Lake formed as compressional forces pushed up Cretaceous rocks into mountains, enclosing a basin during the Early Eocene Epoch (50 million years ago). Fossil Lake existed for approximately 2 million years at an elevation of around 5,100 feet above see level.

The lacustrine (lake) sediments deposited in Fossil Lake comprise the cream-colored rocks visible at the top of Fossil Butte and surrounding hills. These rocks are a small portion of the greater Green River Formation. The Green River Formation also includes two contemporaneous lakes, Lake Gosiute and Lake Uinta, which covered large areas of southwest Wyoming, Utah, and Colorado. Fluvial (stream) sediments in Fossil Basin comprise the red-, purple-, and yellow-banded rocks deposited by rivers prior to, during, and after the existence of Fossil Lake. This sequence of fluvial rocks is called the Wasatch Formation.



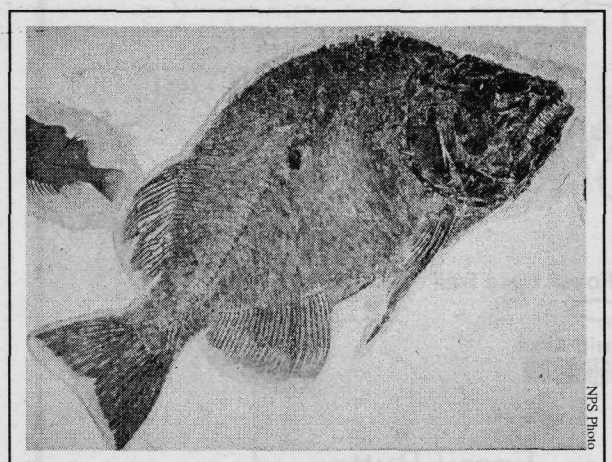
Current research on Fossil Lake focuses on interpreting the final stage of the Lake. As Fossil Lake became shallow and climatic conditions changed, lakewater chemistry was altered. A freshwater wedge developed marginally where streams entered the lake, while saline conditions dominated the center of the lake. Supporting evidence is seen in the rocks and fossils preserved. Near the lake margins micritic limestone indicates freshwater deposition, while in the lake center dolomitic sediments and salt casts indicate saline conditions. This interpretation is supported by fossil evidence. Near the edge of the lake fossils of freshwater organisms are abundant. As the marginal layers are traced basinward, the fossils become fewer and are absent in the dolomitic rocks.

Today, the lake sediments are more than 2,500 feet higher than their original elevation of 5,100 feet. The uplift of the land has resulted in more rapid erosion, which has carved the sediments of the Green River and Wasatch formations into the valleys present today. Erosion continues to expose new rocks and fossils.■ *by Arvid Aase*



# Window into the Past

It all began in the mid-1800s with a few passages from survey reports and journals of early explorers and geologists. They had unexpectedly come across some remarkable fossils of fish and various invertebrates. Interest grew when Union Pacific employees, while constructing the Transcontinental Railroad, discovered an abundance of fossil fish. Funded by eastern museums, expeditions began to uncover a number of plant and animal remains from the surrounding strata. The sheer number, remarkable detail, and incredible diversity of the fossils gained worldwide fame, prompting more excavation and research. In 1972, recognition culminated in the creation of Fossil Butte National Monument.



NPS Photo

The closest living relatives of *Phareodus* are found in subtropical environments of the southern hemisphere today.

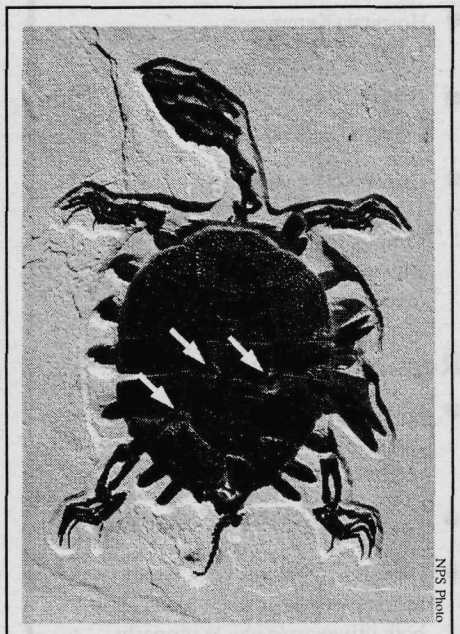
The Monument and surrounding Fossil Basin comprise one of the richest Early Eocene (50 million years old) deposits ever discovered. From the remains of insects and flowers to crocodiles, birds, mammals, and fish, few places can boast such remarkable diversity.

The rocks where these fossils are found are collectively called the Green River Formation, and represent a series of three lakes that existed from the Late Paleocene to the Late Eocene epochs (approximately 57 to 39 million years ago). The Monument presently stands at what would have been the center of the smallest of the three lakes. The sediments of Fossil Lake, as it is called, along with Lake Gosiute and Lake Uinta, have provided abundant fossils that demonstrate Wyoming's climate was much wetter and warmer than today. A boat trip through the Florida Everglades may provide the best contemporary example. Along the shores of these ancient lakes were groves of palm trees and other subtropical vegetation. Insects and birds filled the reedy wetlands with sound, while turtles quietly basked in the sunshine, always wary of crocodiles and alligators. The fate of one turtle on display at the visitor center is clear: crocodilian teeth have punctured its shell.

In Fossil Lake the most common fossils are fish. Over 20 different species have been discovered, including gars, paddlefish, and two freshwater rays. The most abundant fish are the herrings; *Knightia* and *Diplomystus*. In what has been described as mass mortality events, millions of *Knightia* occur in single beds. Although speculation still surrounds the mystery as to why these schools of fish died, it is generally believed that algal blooms, chemical poisoning, or other natural disasters were likely causes.

One of the rarer finds in Fossil Basin are fossil bats. By 1998, after more than 125 years of quarrying, only eight specimens are known to have been discovered. Recent discoveries have added much to our knowledge of early bat evolution. One specimen of *Icaronycteris index* was preserved showing the skull in ventral (bottom) view. This permitted scientists to determine that *I. index* did indeed have the ability to echolocate. Another recently discovered bat may have many more primitive features than *I. index*, the most obvious of which are the claws on each digit in the wing. You can see specimens of *I. index* and other fossil animals and plants at the visitor center.

Today, the Monument and surrounding basin are the center of ongoing geological and paleontological research. Geologists like Paul Buchheim and paleontologists like Lance Grande, along with an endless host of researchers, have provided us with many fascinating insights into this unique and special place. Join us as we unlock the mysteries of an ancient lake ecosystem, and open a window into the past.■ *by Shawn Duffy*



NPS Photo

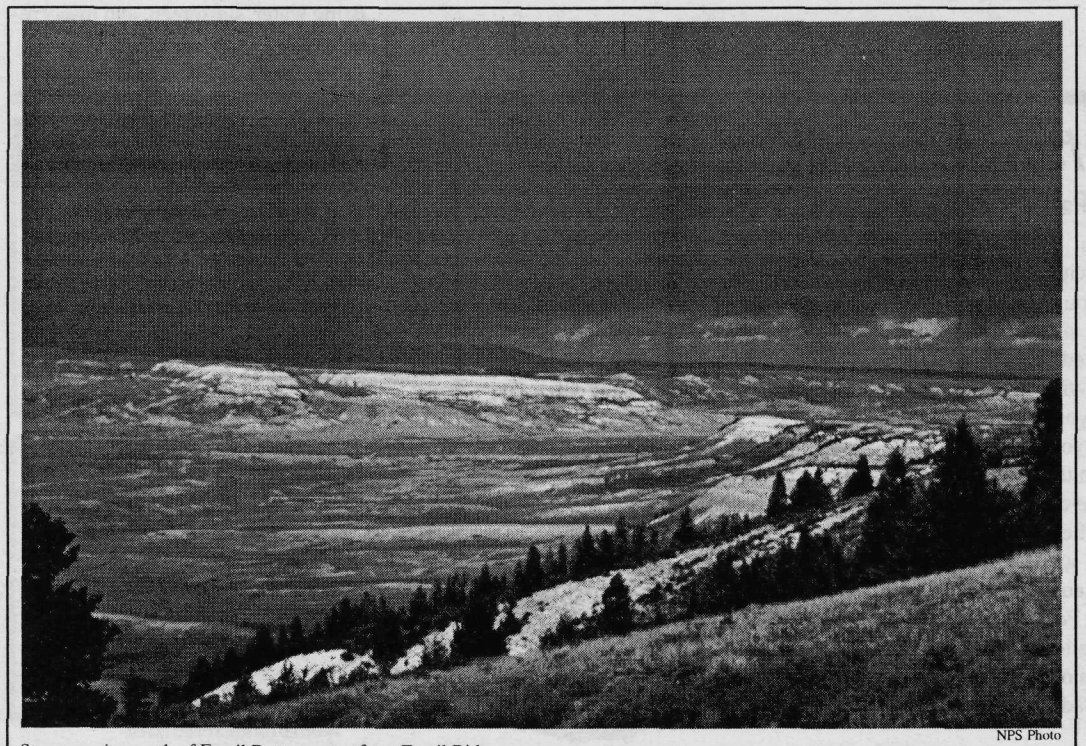
The punctures (arrows) in the shell of this *Trionyx* turtle are likely the result of a crocodilian attack.

## Be a Junior Ranger!

**We invite you to become a junior ranger at Fossil Butte National Monument. Join us by taking time to learn more about what makes Fossil Butte so special.**

## Pins and Patches are Here!

**For a donation of $5.00 or more, you can choose a Fossil Butte National Monument patch or limited-edition pin. Check at the visitor center desk.**



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Storm passing north of Fossil Butte as seen from Fossil Ridge.

## Why I Come Here

Some of my friends think that I'm unusual, in that I don't choose to recreate in a popular or more traditional place like a ski resort. I've worked and lived in 11 different National Park Service areas, but these, too, I am reluctant to explore most of the season, mostly because of crowds. In my search for solitude, I seek out the unheard, the unseen, and the unknown. I've always considered myself lucky to live within striking range of Fossil Butte National Monument because the park has a quality few others can boast of: it is quiet.

I've known about Fossil Butte's unique fossils ever since I was a kid, but the park has other features that few people know about. There are only a few places that are managed for native vegetation. Our parks and preserves represent a tiny fraction compared with the remaining landscape. Fossil Butte is one of the largest in the area, preserving prairies and steppes of the high desert, and it provides both a wealth of information and inspiration to individuals and communities interested in conserving water by landscaping with native vegetation.

In addition to the flora, the wildlife also draws me here. During many of my forays into the Monument, I've had the good fortune to encounter elk, an animal most people don't expect to find here. Other surprises include beaver, and the majestic moose. I discovered long ago that the mosaic of habitats in this semi-arid environment support a great diversity of species, from the popular golden eagle to the lesser-known pigmy rabbit.

One last quality I have come to admire about the Monument is the exhilarating feeling of expansiveness. Above the rolling hills and meadows hangs a vaulted blue sky by day, and a quilt of stars by night. Such characteristics are unique to this landscape, and I remind both my friends and myself that this is something not to be taken for granted.

This is only a sample of the unique treasures at Fossil Butte National Monument. I will leave it to you to discover other qualities that make this place so special.■ *by Shawn Duffy*

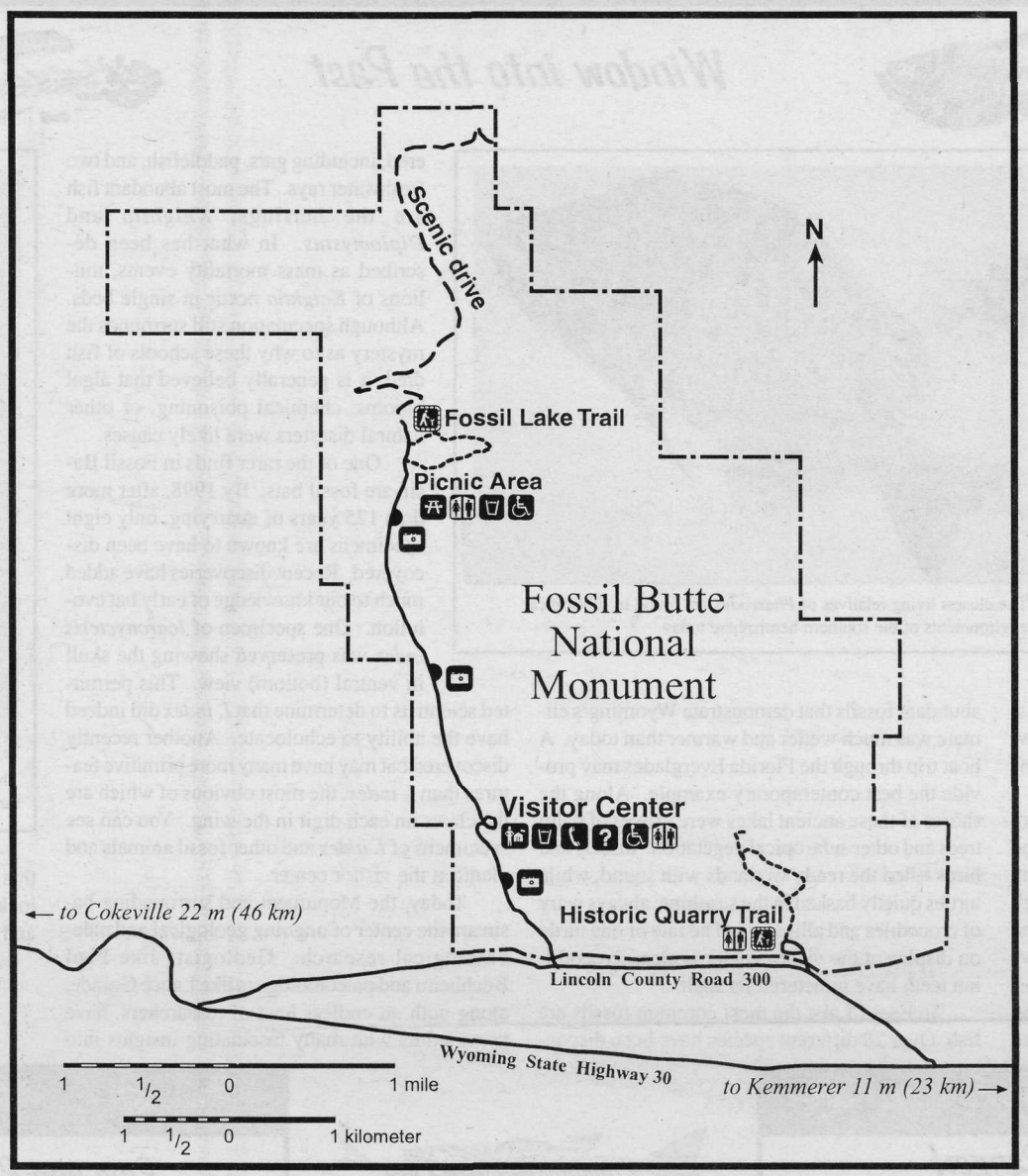
## Emergencies

- For emergencies: **911**
  or **1-800-442-9002**
- Hospital (Kemmerer):
  **1-307-877-4401**
- Highway Patrol:
  **1-800-442-9090**
- Park Visitor Center:
  **1-307-877-4455**
  summer hours, 8am to 7pm daily,
  winter hours, 8am to 4:30pm daily
  (except winter holidays)

## Regulations

- Pets are allowed on both trails and cross-country, but must be under physical restraint.
- Horse use is allowed except on trails.
- Bicycles and motor vehicles are restricted to designated roads with both driver and vehicle properly licensed.
- Snow machines are not permitted in the Monument.
- Camping and overnight parking are not permitted in the Monument.
- Hunting is not permitted in the Monument.
- All cultural and natural objects (including fossils) in the Monument are protected by law, and must be left undisturbed.


For more information, please contact:
Superintendent
Fossil Butte National Monument
P.O. Box 592
864 Chicken Creek Rd
Kemmerer, WY 83101
website: www.nps.gov/fobu


Visitor center
Interpretive foot trail
Picnic area
Restrooms
Information
Wayside exhibit
Wheelchair access
Drinking water
Public phone
Paved road
Improved gravel road
Foot trail
Park boundary

## Services

- Water is available at the visitor center during operating hours, and at the picnic area.
- Primitive camping and public campgrounds are both available on Bureau of Land Management and Forest Service lands (check at visitor center).
- Commercial campgrounds and lodging (reservations recommended in summer), groceries, and other services are available in Kemmerer. For more information, contact the Chamber of Commerce, Kemmerer, WY 83101, 1-888-300-3413.

## Trail Descriptions

- **Historic Quarry Trail**: loop, 2 ½ miles, 600-ft. elevation gain. Provides views of surrounding basin. Wayside exhibits discuss natural and cultural history. A spur trail leads to a historic fossil quarry. Trail guides are available.
- **Fossil Lake Trail**: loop, 1 ½ miles (return via park road), 300-ft. elevation gain. Trail winds through an aspen grove and provides views of a beaver dam and pond. Trail guides are available.

## Safety Tips

- The buttes are prone to lightning strikes. During storms, crouch in a low spot away from trees and cliffs.
- Please enjoy wildlife from a safe distance, and remember that wild animals never benefit from human food, so **please do not feed them!**
- Dress properly for the outdoors. Wear a hat, sturdy shoes, and sunglasses. Bring water, sunscreen, and insect repellent.


# The Big Picture

### Fossils in the National Parks

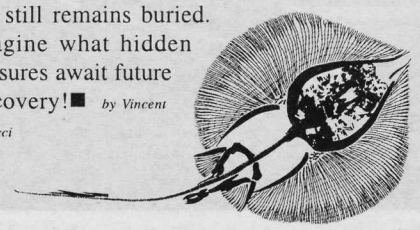

Buried within the buttes of Fossil Butte National Monument are clues of an ancient landscape. Fossilized remains of plants and animals are entombed in 50-million-year-old lake deposits. The story preserved in the rocks and fossils indicates a markedly different environment for southwestern Wyoming in the past.

The visitor center at Fossil Butte displays beautifully preserved examples of organisms that were part of a prehistoric lake ecosystem. The extraordinary preservation of the fossils have enabled researchers to gain a wealth of information about these ancient organisms.

Fossil Butte National Monument preserves a small portion of the fossil record. Over 120 National Park Service units also contain significant fossils. Collectively, the fossils from these parks provide a comprehensive story about the history of life. The staff at Fossil Butte National Monument works closely with the National Park Service Geologic Resources Division in helping to inventory fossil sites within national parks throughout the United States.

Traveling from park to park visitors can travel through time. At Grand Canyon National Park, visitors can hike in the canyon and encounter ancient sea life exposed in the canyon walls. The remains of some of the earliest dinosaurs are found among the petrified logjams at Petrified Forest National Park, while more recent species can be seen at Dinosaur National Monument. The story presented at Fossil Butte National Monument represents a slice of time after the disappearance of the dinosaurs and early in the Age of Mammals. Badlands National Park preserves one of the world's richest deposits of fossil mammals.

The National Park Service helps to protect fossils for both public education and research. Unauthorized collecting is not permitted at Fossil Butte National Monument or any other National Park Service area. If you come upon a fossil during your visit to the Monument, please leave it for others to discover and enjoy. Most of what is to be learned about the history of life still remains buried. Imagine what hidden treasures await future discovery!■ *by Vincent Santucci*



*Dinosaur Nature Association*

The Dinosaur Nature Association supports the National Park Service by developing educational materials that interpret the resources of Dinosaur and Fossil Butte National Monuments and Flaming Gorge National Recreation Area. All sales help the interpretive and scientific programs at these parks.


*Fossil Butte Shore Lines* was created by the staff of Fossil Butte National Monument.

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