Florissant Fossil Beds
Fossil Plants

National Park Service
U.S. Department of the Interior

Florissant Fossil Beds
National Monument
Colorado

More than 130 plant species have been described from Florissant. These are represented by leaves, fruits, flowers, seeds, wood, and pollen, yet the only fossils most visitors see are the stumps of ancient redwood trees. Why is this? Fossilization is a complex process that can be affected by a number of factors, and multiple forms of fossilization took place during Eocene Florissant.

How were the fossil plants preserved?

Most of the plant diversity at Florissant comes from the abundance of plants preserved in shale. The volcanic mudflow that preserved the redwood stumps was very high-energy, meaning that only the most durable plant parts, such as trunks, cones, and seeds, survived the flow intact. More delicate plant parts like leaves and flowers were preserved poorly or not at all.

Delicate plant parts were deposited at the bottom of Lake Florissant, a low-energy, low-oxygen environment. Their fine features are preserved in paper shale, a very fine grained rock produced by the deposition of volcanic ash and a kind of microscopic algae called diatoms. These delicate fossils are still trapped within layers of rock and are only revealed through natural weathering, which causes the fossils to deteriorate, or excavations by the paleontology staff. During excavations, monument paleontology staff dig out pieces of shale, split them to reveal the fossils, and bring them back to the lab where they are safe from the elements.

Where did the Eocene plants live?

Eocene Florissant was made up of a variety of plant habitats, ranging from the aquatic environment of Lake Florissant to the drier and harsher environments of the surrounding mountainsides. Since most of the plants represented by fossils are terrestrial species, they had to be transported into the lake from wherever they grew, facing possible destruction in the process. Therefore, the distance between a plant and the lake greatly influenced the likelihood of it being fossilized.

Species like *Sequoia* (redwood, left) were preserved frequently because they lived in wet valley bottoms near the lake. Pine (above left), mountain mahogany (above center), and oak (above right), which are seen less frequently as fossils, lived on more distant hillsides.

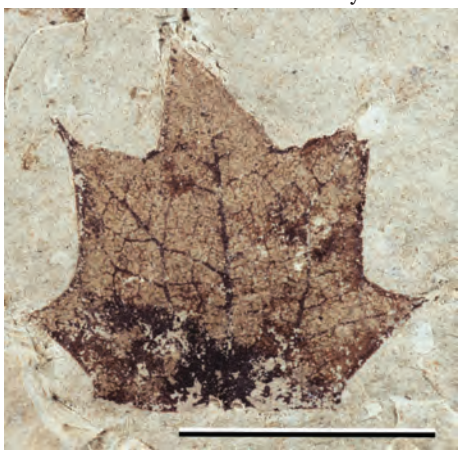
The abundance of certain species also plays a role in how often they are preserved. *Fagopsis longifolia*, the most common fossil plant found at Florissant, is an understory tree that inhabited the banks of the lake and streams. The number of these fossils relative to those of other species suggests that *Fagopsis* was also one of the most common species in the Eocene environment.

Left: *Sequoia* FLFO-3661; Above left to right: *Pinus* FLFO-11481, *Cercocarpus* FLFO-4096, *Quercus* UCMP-3661; Right: *Fagopsis* YPM-30121

Why are fossil leaves so common?

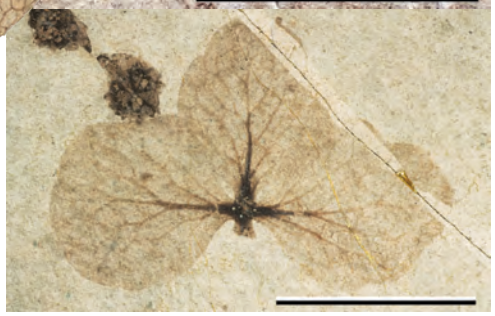
Plants in the fossil record are unique in how certain organs are preserved preferentially. A plant organ is a part of a plant that has a specialized function. For example, leaves are considered organs because they are responsible for collecting sunlight for photosynthesis. Other plant organs include flowers, seeds, fruits, and stems.

Unlike animals, while a plant is alive it continually releases and regrows many of its organs. All plants, even evergreens, drop leaves. All plants release reproductive structures such as pollen, seeds, and fruit. This means that many isolated plant organs can be found in depositional environments like the bottom of Lake Florissant. Therefore, leaves and reproductive structures are more commonly seen in the fossil record than other plant parts that are not released from the plant during its life, such as the wood of a trunk or stem.



The durability of a plant organ also affects its fossilization. Certain leaves are more likely to reach a depositional environment intact than others.

Evergreen leaves, like *Mahonia* (a relative of holly, left), are thicker than deciduous leaves, making them better able to withstand damage during transport and more likely to be well preserved.



Fossil fruits and flowers (above) like *Asterocarpinus*, *Florissantia*, and *Hydrangea* are rare at Florissant. This is because they are very fragile and can easily fall apart or be destroyed before being buried.

Left: *Mahonia* UCMP-3764; Top left: *Florissantia* flower UCMP-3619 (width 2.6 cm, 1 in); Top right: *Asterocarpinus* fruit UCMP-198424; Right: *Hydrangea* flower YPM-23931.

What happened to the Eocene Florissant plants?

At the end of the Eocene, there was a drop in global temperature and the Florissant climate began to change from subtropical/warm temperate to cooler temperate. In response to the intense cooling, many plants native to the ecosystem that were not cold-adapted either became extinct or dispersed to other parts of the world.

The two most abundant plant fossils at Florissant, F*agopsis*, a relative of beech, and *Cedrelospermum*, a relative of elm, became extinct.

The last living species of *Sequoia*, the coastal redwood, lives on the US Pacific coast. *Koelreuteria* (golden rain tree, far left) and *Ailanthus* (tree of heaven, left), two types of trees widespread during the Eocene, now live only in Asia and Oceania.

Many genera present in Eocene Florissant survived under the colder conditions. These include plants which are still common across North America, including *Acer* (maple), *Rosa* (rose), *Carya* (hickory), and *Hydrangea*. At Florissant, *Pinus* (right) and *Populus* (far right) have survived since the Eocene and are abundant today as Ponderosa pines (*Pinus ponderosa*) and quaking aspens (*Populus tremuloides*).

Above: left, *Koelreuteria* YPM-30055; right, *Ailanthus* UCMP-141996. Right: *Pinus* FLFO-9362; Far right: *Populus* FLFO-3959.

Scale bars are 1 cm (0.4 in).

Images courtesy of Yale Peabody Museum (YPM), University of California Museum of Paleontology (UCMP), and Florissant Fossil Beds National Monument (FLFO).