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COLORADO'S ANCIENT BRISTLECONE PINES

By

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Rocky Mountain bristlecone pines (scientific name *Pinus aristata*) are native to Colorado, New Mexico, and Arizona. Since 1972, the oldest living tree of this species was thought to be a 1,591+ year-old tree in north-central Colorado. However, in 1989-1991, researchers from the U.S. Geological Survey and the University of Colorado found 14 living Rocky Mountain bristlecone pines in central Colorado that are more than 1,600 years old. The oldest living Rocky Mountain bristlecone pine they found dates back to at least 442 B.C., so it is a minimum of 2,436 years old. Scientists estimate the actual age of this tree to be about 2,500 years. In addition to being the oldest known living tree of its species, this tree is the oldest known living tree in Colorado. Of the 14 living bristlecone pines in Colorado that are known to be more than 1,600 years old, four are more than 2,100 years old. The ancient trees are on National Forest land, and the U.S. Forest Service has asked that the exact location of the trees not be revealed, in order to protect the trees.

Colorado's ancient bristlecone pines grow in some of the driest mountain areas in the State, in scattered groves on steep rocky slopes at altitudes of 10,600-11,700 feet. Summer is cool and short at these high altitudes. In this harsh environment, the trees are stunted, attaining heights of only 9-25 feet. Throughout most of their long lifetimes, they grow very slowly, adding only 1-1.5 inches of girth every 100 years. Longevity of these trees seems to be related to their ability to adapt to adverse environmental conditions.

Forest fires do not start or spread easily in the ancient bristlecone pine groves because the trees are widely spaced and because the rocky ground surrounding the trees supports only a few other species of low plants and shrubs that could serve as fuel for a fire. In addition, some of the groves are surrounded by barren expanses of bedrock and boulders that prevent the spread of fire from neighboring forested areas.

The trunk of each ancient living tree is exposed wood except for one or two strips of bark that connect a few living branches to sturdy roots. Through the centuries, wind-driven snow and sand gradually erode and sculpt the exposed wood into the forms we see today. Close inspection of the wood reveals intricate textures, such as furrows and ridges. Wood surfaces are silvery gray and rich shades of amber to dark brown, which contrast with the trees' green needles.

George Engelmann, an American botanist, described and named the trees we now call Rocky Mountain bristlecone pines on the basis of branches collected in 1861 near Pikes Peak and at the headwaters of Clear Creek, Colorado. The scientific name Engelmann gave to this species of pine is *Pinus aristata* (pronounced "pie'-ness ā-riss-tay'-tuh"), which is Latin. *Pinus* means "pine tree," and *aristata* means "provided with awns" or "bristly," referring to the bristles on the cones. *Pinus aristata* in Colorado are one of three related tree species:

- Rocky Mountain bristlecone pines (scientific name *Pinus aristata*), which are native to Colorado, New Mexico, and Arizona. Maximum known life span is about 2,500 years.
- Great Basin bristlecone pines (scientific name *Pinus longaeva*), which are native to California, Nevada, and Utah. Maximum known life span is about 4,900 years.
- Foxtail pines (scientific name *Pinus balfouriana*), which are native to California. Maximum known life span is about 1,200 years.

To determine the age of a bristlecone pine, without harming it, a tiny core sample is carefully collected from the tree using a special tool called an increment borer. Scientists examine the core sample under a microscope and carefully count the number of rings in the core sample; one ring forms each year. Scientists use a technique called "crossdating" to match narrow and wide rings in the core sample with narrow and wide rings in core samples from nearby trees. Crossdating is necessary to make sure that occasional very narrow or missing rings are not

overlooked in each core sample. Rings are very narrow or missing in some trees because of abnormally dry and (or) cold environmental conditions or because of tree injury in certain years. For example, core samples from bristlecone pines at a site in central Colorado have very narrow and missing rings for the year 1963, a year in which the spring and early summer were unusually dry. At the same site, over the past 200 years, very narrow and missing rings are also recorded in core samples for the years 1851, 1861, 1880, and 1979.

Rocky Mountain bristlecone pines can be seen in their natural environment along the road to Mount Evans, which is about 35 miles west of Denver. The road passes through the Mount Goliath Natural Area (part of Arapaho National Forest), which has been set aside for the preservation of bristlecone pines. Another place to see bristlecone pines is the Windy Ridge Bristlecone Pine Scenic Area (part of Pike National Forest), which is near the town of Alma in South Park, about 65 miles southwest of Denver. Although neither of these two areas contains Colorado's oldest known living bristlecone pine, some living trees in the two areas far exceed 500 years in age.

Bristlecone pines are useful to science because the widths and structure of their rings are influenced by variations in climate. Climate records for the Western United States extend back less than 150 years, so scientists look to the long tree-ring records contained in ancient bristlecone pines to provide information on past climate and to possibly help predict the climate of the future.

COLORADO'S OLDEST KNOWN LIVING BRISTLECONE PINES

Tree-ring date	Minimum age (years)	Age estimate (years)	Location
442 B.C.	2,436	2,500	Near South Park.
304 B.C.	2,298	2,450	Near South Park.
191 B.C.	2,185	2,200	Near South Park.
167 B.C.	2,161	2,300	Near South Park.
A.D. 14	1,980	2,000	Near Pikes Peak.
A.D. 57	1,937	1,980	Near South Park.
A.D. 99	1,895	1,950	Near Pikes Peak.
A.D. 152	1,841	1,850	Near South Park.
A.D. 162	1,831	1,840	Near South Park.
A.D. 183	1,811	1,830	Near South Park.
A.D. 324	1,670	1,690	Near South Park.
A.D. 343	1,651	1,670	Near South Park.
A.D. 349	1,642	1,660	Near South Park.
A.D. 358	1,634	1,640	Near South Park.
A.D. 403	1,591	1,600	Near Mount Evans.

Notes: The tree-ring date and the minimum age are determined from the oldest ring in the core sample collected from each tree. The number of years that are added to the minimum age to obtain the age estimate depends upon how close to the "center" (pith) of the tree the core sample was taken and upon the growth rate of the tree.

SOME HISTORICAL EVENTS DURING THE LIFE OF COLORADO'S OLDEST KNOWN BRISTLECONE PINE

- B.C.** 442--*Bristlecone pine is a young tree 12 feet tall and about 50 years old.*
431-404--Peloponnesian War wrought the ruin of Athens and the Athenian fleet.
221--End of the age of warring states in China. For the first time in history, China becomes a single nation.
58-50--Julius Caesar conquers Gaul (France, Belgium, and parts of Holland, Germany, and Switzerland).
37--Cleopatra and Antony marry.
- A.D.** 0--*Bristlecone pine is about 500 years old.*
About 1--Arrival of Indians at Mesa Verde, Colorado.
64--Rome burns.
79--Mt. Vesuvius erupts, burying Pompeii.
435-453--Attila, king of the Huns, raids the Danube provinces.
476--Start of the Dark Ages in Europe.
500--*Bristlecone pine is about 1,000 years old.*
About 900--Fall of the Mayan civilization.
1100-1300--Classic Pueblo period at Mesa Verde. Spectacular cliff dwellings at Mesa Verde built.
1275-1292--Marco Polo in China.
About 1300--Cliff dwellings at Mesa Verde abandoned.
1347--Outbreak of the Black Death (Bubonic plague). By 1377, at least 40 percent of the population of Europe died. Continuing outbreaks until the 1600's.
1368-1644--Ming Dynasty in China.
1400-1519--Aztec empire.
1438-1538--Inca empire.
1457--Publication date of oldest surviving book made by a printing press.
1492--Christopher Columbus sails to the Bahamas.
1500--*Bristlecone pine is about 2,000 years old.*
1564--William Shakespeare born.
1585--First English colony in North America at Roanoke Island, North Carolina.
1606--Discovery of Australia by European sailors.
1789--George Washington inaugurated as first President of the United States.
1806--Lieutenant Zebulon Pike expedition in Colorado.
1833-1839--Invention of photography.
1849--California gold rush.
1859--Colorado gold rush.
1861--Colorado Territory created.
1876--Colorado becomes a State.
1903--Wright brothers fly airplane.
1914-1918--World War I.
1924--First airplane flight around the world.
1936--First television broadcast.
1939-1945--World War II.
1969--Astronauts land on the moon.
1993--*Bristlecone pine is about 2,500 years old.*

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