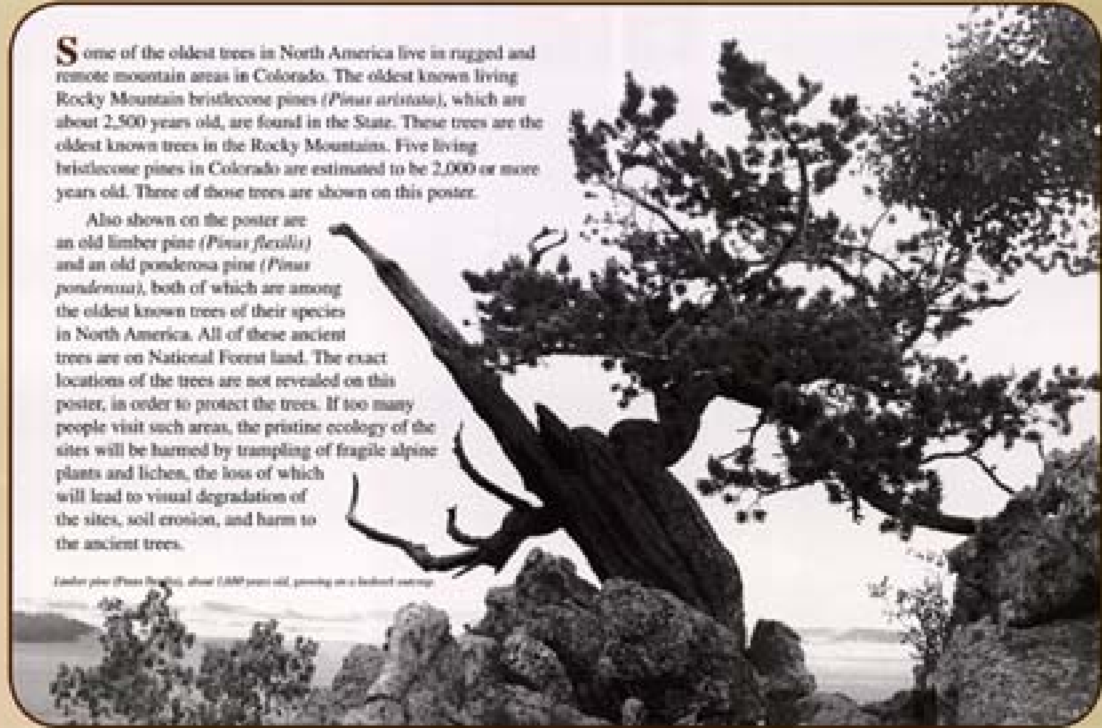
# Colorado's Ancient Trees

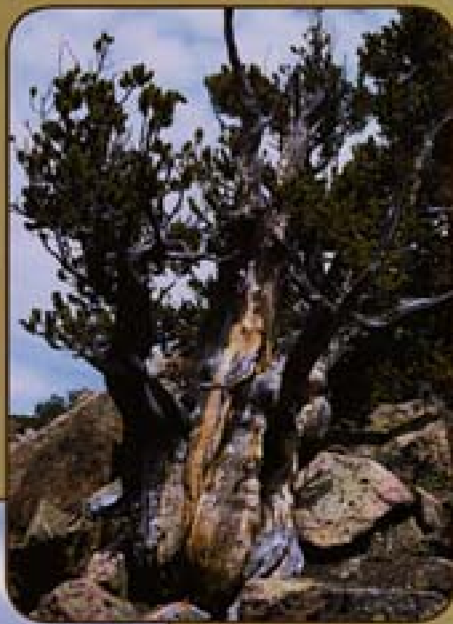
Some of the oldest trees in North America live in rugged and remote mountain areas in Colorado. The oldest known living Rocky Mountain bristlecone pines *(Pinus aristata)*, which are about 2,500 years old, are found in the State. These trees are the oldest known trees in the Rocky Mountains. Five living bristlecone pines in Colorado are estimated to be 2,000 or more years old. Three of those trees are shown on this poster.

Also shown on the poster are an old limber pine *(Pinus flexilis)* and an old ponderosa pine *(Pinus ponderosa)*, both of which are among the oldest known trees of their species in North America. All of these ancient trees are on National Forest land. The exact locations of the trees are not revealed on this poster, in order to protect the trees. If too many people visit such areas, the pristine ecology of the sites will be harmed by trampling of fragile alpine plants and lichen, the loss of which will lead to visual degradation of the sites, soil erosion, and harm to the ancient trees.

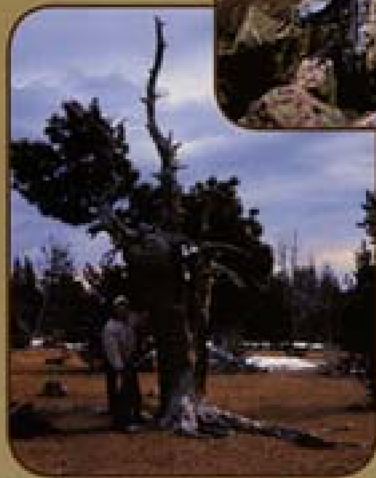


*Limber pine (Pinus flexilis), about 1,000 years old, growing on a bedrock outcrop.*

*In the cool and relatively dry environment near upper treeline, the wood of dead bristlecone pines can persist for hundreds to thousands of years. This wood can be used by scientists to extend the tree-ring record far back in time.*



*(ABOVE) Rocky Mountain bristlecone pine (Pinus aristata), about 2,000 years old, growing among large lichen-covered granitic boulders. Several species of lichen are present; their colors include shades of green, yellow, gray, and orange. Younger trees are in the background.*



*(LEFT) Exposed dead roots of this Ponderosa pine (Pinus ponderosa), about 800 years old, reveal how much erosion of the granitic soil has taken place during its lifetime.*

Because of the harsh alpine environment in which these trees grow, they are stunted, attaining heights of only 10-25 feet (3-8 meters). Longevity of these trees seems to be related to their ability to adapt to adverse environmental conditions. The ancient trees are partly protected from forest fires because the rocky ground surrounding the trees supports only sparse amounts of low plants and shrubs that could serve as fuel for a fire, and because the trees usually grow far apart from each other.

The trunk of each of these ancient living trees is exposed wood except for thin 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 shades of amber to dark brown, which contrast with the trees' green needles.

To determine the age of an ancient tree, 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; 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 can be very narrow or missing in some trees because of abnormally dry environmental conditions or because of tree injury. For example, trees studied at an arid site in central Colorado have very narrow or missing rings for the year 1963, a year in which the spring and early summer were unusually dry.

*Alpine primrose (Primula angustifolia), only a few inches tall, grows in gravelly granitic soil near upper treeline among bristlecone pines.*

*Fully open cone on branch of Rocky Mountain bristlecone pine has released its crop of seeds. Current year's needles on the tip of the branch have broken through their protective sheath but have not completely spread out.*

*Unopened cones on branch of Rocky Mountain bristlecone pine. These cones will open, turn brown, and release their seeds. Note the bristles on the cones, a feature for which the tree is named ("bristlecone"). The needles have numerous white resin specks, which are characteristic of this tree species. Current year's needles at the tip of the branch have not yet emerged from their protective sheath.*

*(LEFT) James saxifrage (Telesonix jamesii) grows out of a crack in a vertical face of weathered granitic bedrock. Bristlecone pines grow nearby.*

*(RIGHT) Alpine sunflower (Hymenoxys grandiflora), also known as "Old-man-of the-mountain," growing in a bristlecone pine grove at about 12,100 feet (3,690 meters) altitude.*

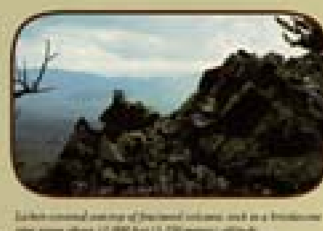
Dead standing trees and pieces of weathered "driftwood" in ancient tree sites are attractive as well as important sources of scientific information. They can extend the tree-ring record further back in time than the oldest living trees. Therefore, such dead wood should be left in place, so that it can be studied by future generations.

Rocky Mountain bristlecone pines can be seen in their natural environment along the road to Mount Evans, which is about 35 miles (56 kilometers) west of Denver. The road passes through the Mount Goliath Natural Area (part of Arapaho National Forest), which has been set aside to preserve 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 (105 kilometers) southwest of Denver. Some of the living trees in these areas exceed 1,000 years in age.

Ancient trees are aesthetically appealing, and they are useful to science because the widths, structure, and chemical composition of their rings are influenced by variations in climate. Because climate records for the Western United States extend back less than 150 years, scientists often look to tree-ring records to provide information on past climate and to possibly help predict future climate.

*Magnified view of annual rings of a Douglas fir (Pseudotsuga menziesii), in central Colorado. Note that the 1963 annual ring is much narrower than surrounding rings, probably due to the unusually dry spring and early summer that occurred in 1963 in central Colorado. [illegible]*

*Each tree ring is made up of earlywood (E) and latewood (L), which together constitute one year's growth. [illegible]*

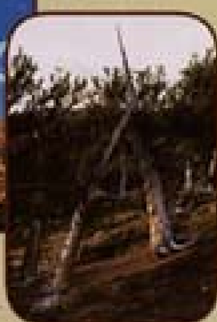


*Lichen-covered outcrop of fractured volcanic rock in a bristlecone pine grove above 11,000 feet (3,350 meters) altitude.*

*A steep, rocky talus slope has been the home of this Rocky Mountain bristlecone pine since about 450 B.C., making this tree about 2,450 years old. The contorted limb at the lower left has living branches; the rest of this tree's limbs as well as its top are dead. Younger living trees are in the background.*

*For about 2,200 years, this Rocky Mountain bristlecone pine has lived on the rocky talus slope. The nearly treeless basin in the distance is about 3,300 feet (1,000 meters) below. The age of this tree and the slow growing lichens that cover the rocks provide evidence that this slope has remained stable for two millennia. Youthful bristlecone pine on the left (in gray trunk) is visible at the lower left is taller than its ancient neighbor, but it is only about 300 years old.*

*(LEFT) View from a grove of bristlecone pines and Engelmann spruce to distant slope that has scattered dwarf trees at treeline. Top of distant ridge is about 12,300 feet (3,750 meters) altitude.*



*(RIGHT) Bristlecone pine grove high up in the Colorado Front Range. The two trees in the foreground are more than 2,000 years old. Late July wildflowers cover the gravelly granitic soil.*

### The World's Oldest Known Trees

| Common name (scientific name) | Estimated age (years) | Location |
|---|---|---|
| Great Basin bristlecone pine (*Pinus longaeva*) | 4,600-4,900 | California and Nevada, U.S.A. |
| Alerce (*Fitzroya cupressoides*) | 3,620 | Chile |
| Giant Sequoia (*Sequoiadendron giganteum*) | 3,200-3,500 | California, U.S.A. |
| Rocky Mountain bristlecone pine (*Pinus aristata*) | 2,500 | Colorado, U.S.A. |
| Coast Redwood (*Sequoia sempervirens*) | 2,200 | California, U.S.A. |
| Foxtail pine (*Pinus balfouriana*) | 2,200 | California, U.S.A. |
| Western juniper (*Juniperus occidentalis*) | 2,200 | California, U.S.A. |
| Subalpine larch (*Larix lyallii*) | 1,920 | Alberta, Canada |
| Rocky Mountain juniper (*Juniperus scopulorum*) | 1,890 | New Mexico, U.S.A. |
| Limber pine (*Pinus flexilis*) | 1,670-1,680 | Colorado and New Mexico, U.S.A. |
| Baldcypress (*Taxodium distichum*) | 1,620 | North Carolina, U.S.A. |
| Douglas fir (*Pseudotsuga menziesii*) | 1,350 | British Columbia, Canada |
| Huon pine (*Lagarostrobus franklinii*) | 1,080 | Tasmania, Australia |
| Northern white cedar (*Thuja occidentalis*) | 1,040 | Ontario, Canada |
| Pinyon pine (*Pinus edulis*) | 980-1,000 | Utah, U.S.A. |
| Whitebark pine (*Pinus albicaulis*) | 800-890 | Alberta, Canada |
| Ponderosa pine (*Pinus ponderosa*) | 800-850 | Utah, U.S.A. |
| Engelmann spruce (*Picea engelmannii*) | 850-860 | Colorado, U.S.A. |

*Much of the information in this table is from Peter M. Brown's 1996 paper entitled OLDLIST: A database of maximum tree ages, which is contained in the volume entitled Tree rings, environment, and humanity [illegible]*

Suggested general reading: [illegible]

Text and photographs by P.C. Brunstein
Design and digital layout by Carol Quesenberry

[illegible] provided thoughtful reviews of this poster. [illegible]

Photograph of ponderosa pine taken in 1995; photographs taken 1994, all others taken 1990-95.

U.S. Department of the Interior
U.S. Geological Survey
Prepared in cooperation with the
U.S. Department of Agriculture, Forest Service