PONDEROSA PINE

Pinus ponderosa, Pine family—Pinaceae

Ponderosa pine is a quintessential symbol of the expansive, semi-arid landscape of the American West. Typically it is the first forest tree to greet travelers emerging from a tiresome journey across steppes covered with nothing taller than sagebrush or bushy junipers. Its stout trunk is clad in handsome orange-brown bark, and its big, sturdy branches support a luxuriant canopy of long-needled foliage. Ponderosa borders the desert because it is superior to other forest trees in adapting to drought. It also is finely attuned to a dry environment historically shaped by frequent fires. Ponderosas commonly lived 500 years or more in part because of fires burning beneath them every decade or so.

In the early 1900s, ponderosa pine was still found in sunny, parklike forests dominated by large trees, but today many of these places are radically changed. Crowded with small trees (often firs) and deadfall, they are prone to severe wildfires and epidemics of insects and disease. These forests now contain millions of homes and other developments. At long last, some private landowners and managers of public lands are carrying out treatments designed to restore a semblance of the historic grandeur to ponderosa pine forests.

Where It Grows

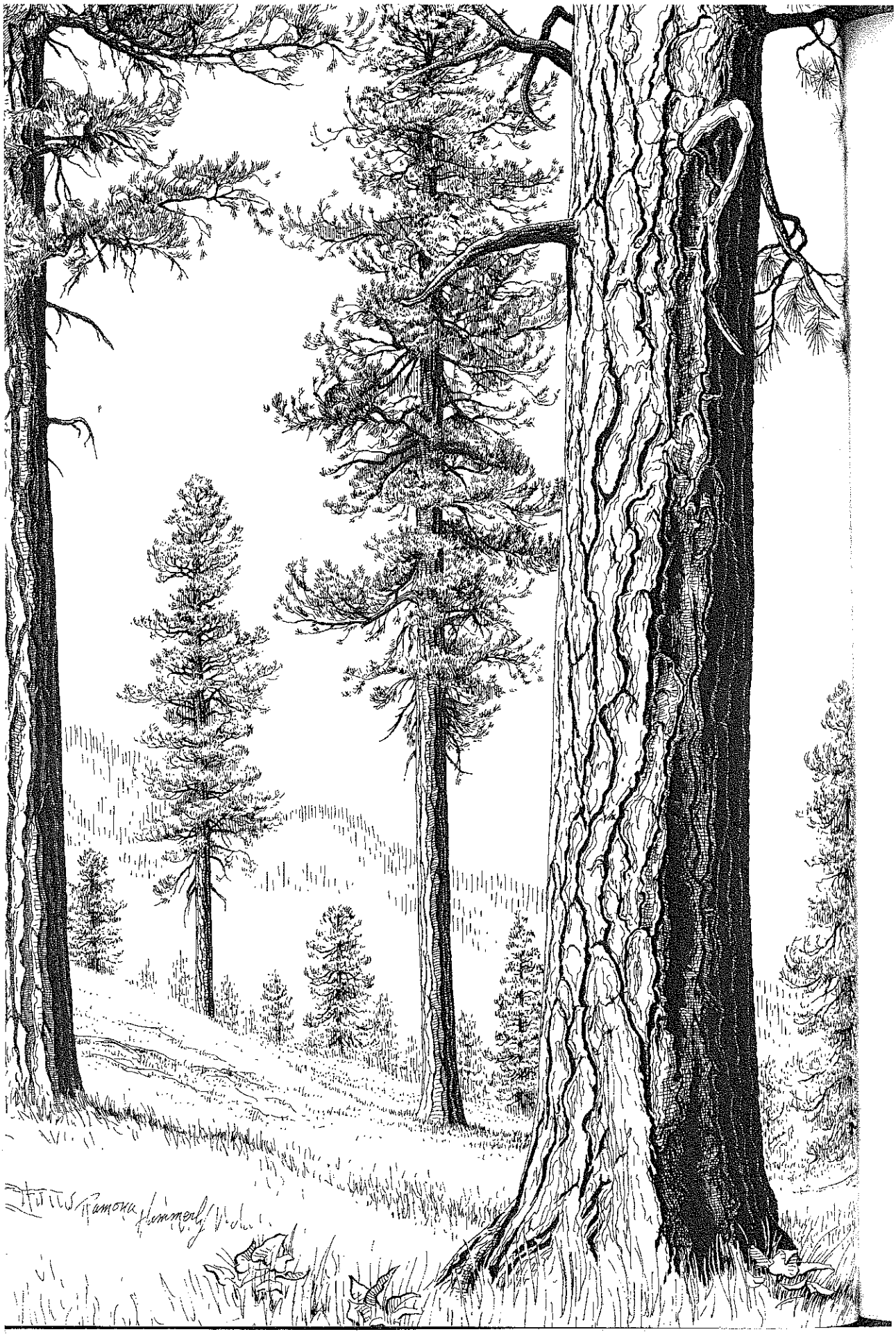
Ponderosa pine is characteristic of relatively warm, dry forests throughout the West, from southern British Columbia to southern California, New Mexico, and South Dakota. Ponderosa is absent from some regions that have short, cool summers punctuated by frequent frost, such as southern Alberta, the greater Yellowstone Park area, and much of the Great Basin. It also grows poorly in damp coastal environments, and thus it is absent from most of western Washington and southwestern British Columbia. Isolated populations occur in a few areas west of the Cascades, notably at the head of Ross Lake in southernmost British Columbia, the Fort Lewis prairies near Tacoma, Washington, and the Willamette Valley in Oregon. In southwestern Oregon and northwestern California, the maritime climate is confined to a narrow band along the coast, and east of this the ponderosa becomes common.

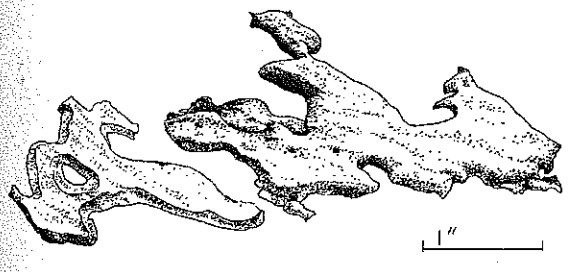
Ponderosa is well adapted to the warm, dry mountain country between the Cascade crest and the Continental Divide. For example, in central Idaho it descends to 1000 feet (300 m) elevation in deep canyons, but it also prospers as high up as 6500 feet (2000 m) on south-facing ridges.

Appearance

Healthy young ponderosa pines have broad crowns made up of regular whorls of long limbs. The canopy is rather open, with branches well separated. Their foliage consists of 5- to 8-inch-long (13- to 20-cm-long) needles mostly borne in groups of three. (Ponderosa pines east of the Continental Divide often bear needles in clusters of two.) Also, the large buds at the tips of branches are protected by a tuft of long needles. These characteristics help ensure that some of the small trees survive low-intensity fires. Young trees have rough, dark-brown bark, but as they age, the bark gradually becomes bright orange-brown and is divided into plates by a network of dark fissures—a favorite subject of artists and photographers.

As young trees grow tall, their lower branches normally die. Historically, they were pruned by repeated fires, resulting in mature trees having a branch-free trunk extending high





flakes of ponderosa pine bark

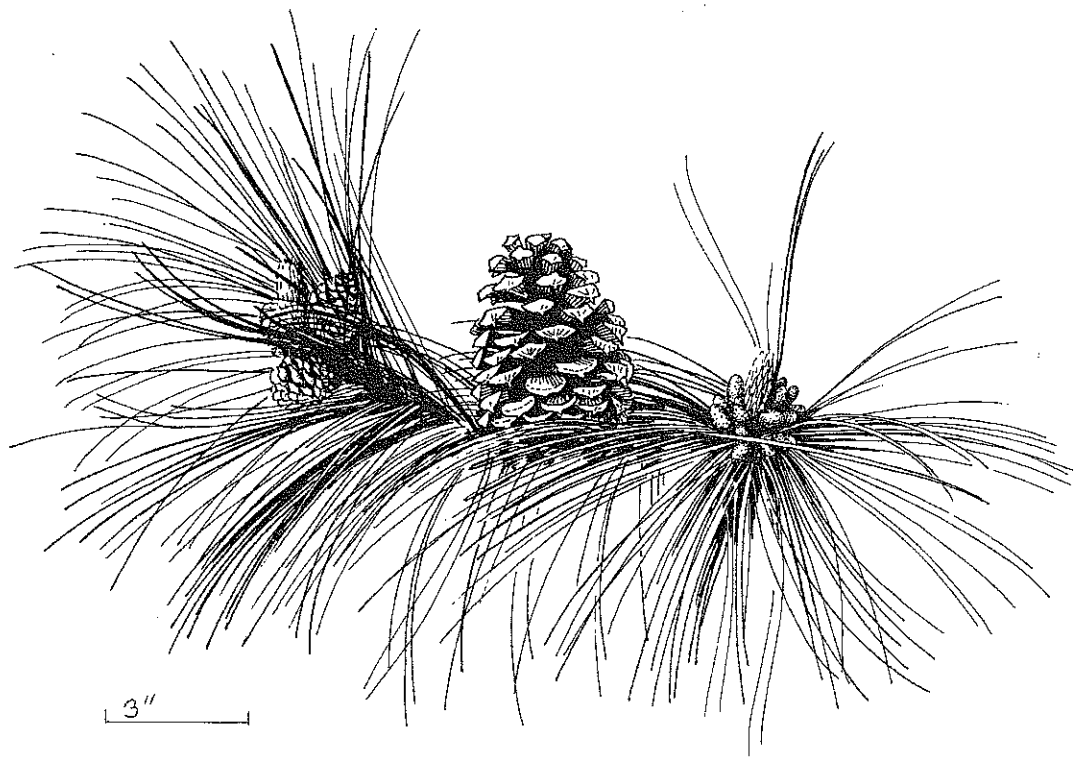
above the ground. Botanical explorer David Douglas named these trees "ponderosa" (related to "ponderous") because of their great size. On good sites, the largest old trees commonly attain diameters of 4 feet (1.2 m) and heights of 130 feet (40 m) or more. The biggest individual ponderosas in Washington, Oregon, California, and Idaho are 7 feet (2 m) or more in diameter and about 200 feet (60 m) tall. Trees greater than 500 years old can often be distinguished by especially smooth and pale orange bark and a flat-topped canopy composed of great gnarled branches and thin, ropy branchlets.

Ponderosa pine cones are often abundant on and underneath the trees. They are mostly 3 to 5 inches (8 to 13 cm) long, egg-shaped, and purple when the squirrels fell them but becoming brown and almost spherical when they dry and the scales flex open. The back of each scale is armed with a sharp prickle that sticks out and soon teaches people to be careful when handling these cones.

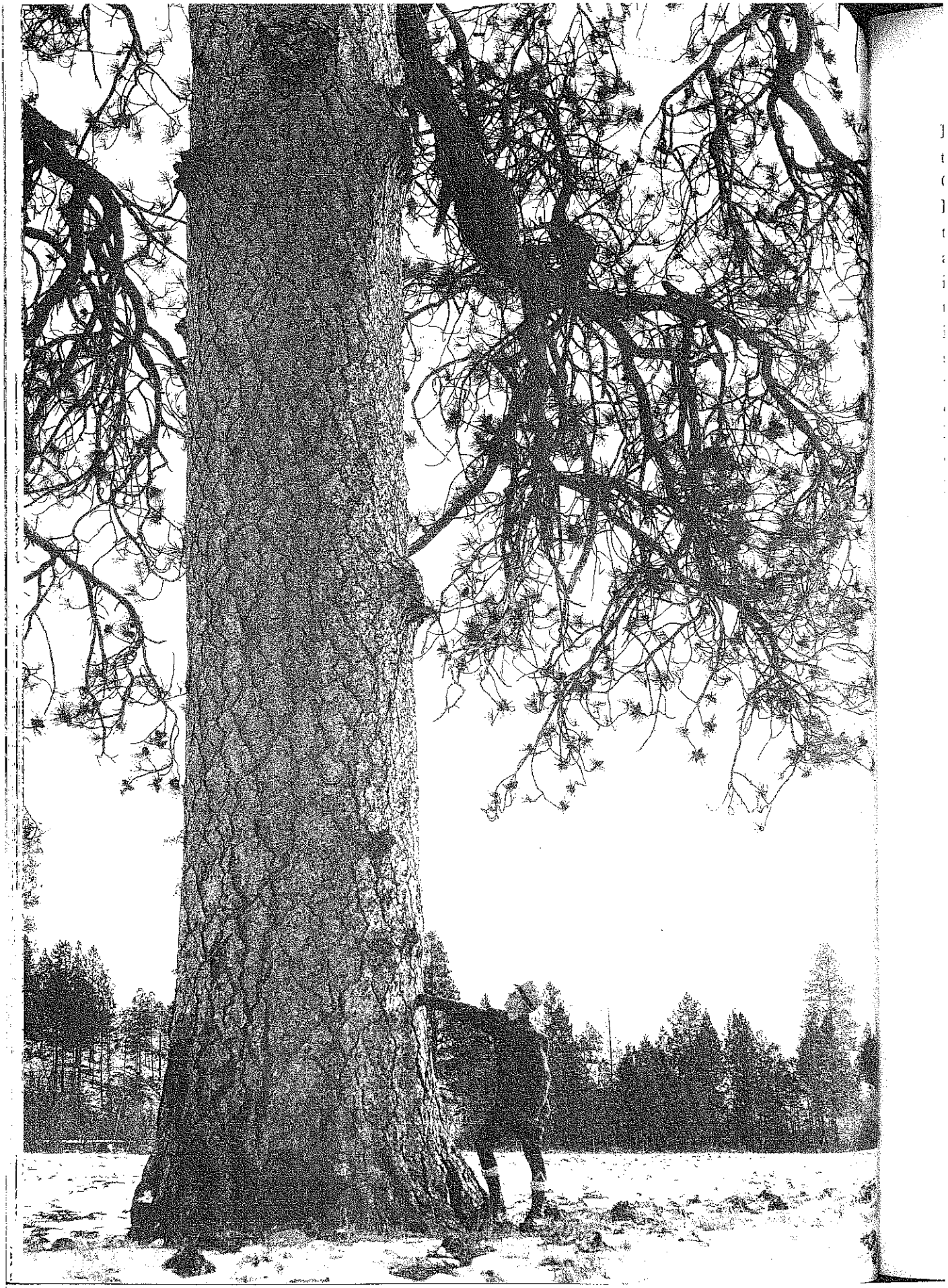
Ecological Role

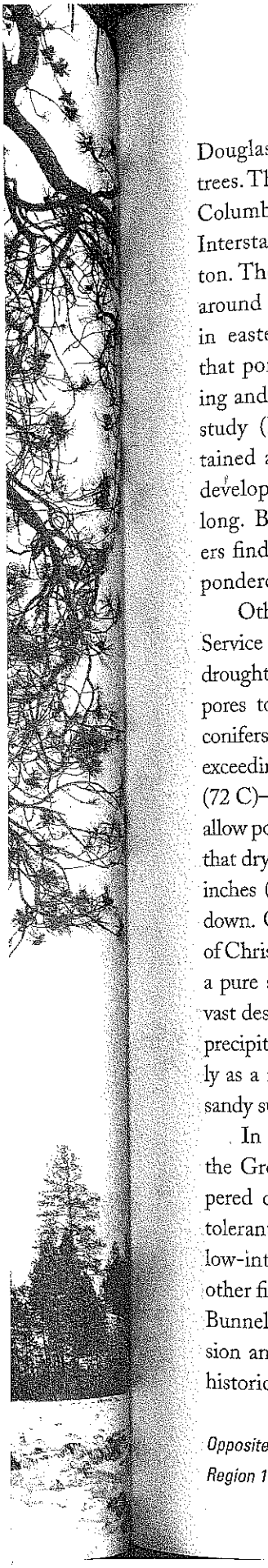
Ponderosa pine is shade intolerant, so if more shade-tolerant trees are present, they tend to replace ponderosa in forests that are protected from fire and other major disturbances. Such associates include inland Douglas-fir, grand fir, white fir, and incense-cedar. How is it, then, that a shade-intolerant species became one of the most widespread trees in the American West? Its success is due to two traits: superior drought tolerance and adaptation to frequent fires.

In large parts of its distribution, ponderosa pine forests develop in sites too dry for



ponderosa pine





Douglas-fir and other less drought-tolerant trees. These pure ponderosa forests border the Columbia Basin desert, for example, along Interstate 90 west of Spokane, Washington. They also occupy droughty pumice soils around Bend, Oregon, and extensive areas in eastern Montana. Physiologists learned that ponderosa pines are superior in accessing and conserving moisture. In one historic study (Bates 1924), year-old seedlings attained a height of only 3 inches (8 cm) but developed taproots nearly 24 inches (60 cm) long. Because of these deep roots, gardeners find it difficult to successfully transplant ponderosa saplings.

Other studies (Smith 1985; U.S. Forest Service 1990) disclosed that during summer drought, the ponderosa is able to close its leaf pores to prevent water loss better than other conifers, and its seedlings are able to withstand exceedingly high temperatures—162 degrees F (72 C)—at the ground surface. These attributes allow ponderosas to colonize rocky or sandy soils that dry out to lethal levels in the upper 24 to 36 inches (60 to 90 cm) but remain moist farther down. Central Oregon's Lost Forest, northeast of Christmas Valley, is a dramatic example. Here a pure stand of ponderosa pine thrives amid a vast desert where less than 10 inches (25 cm) of precipitation falls in the average year, evidently as a result of water available deep under the sandy surface.

In much of its historic distribution in the Greater Northwest, ponderosa pine prospered despite competition from more shade-tolerant firs, due to its ability to survive frequent low-intensity fires, protected by thick bark and other fire-resistant features (Arno and Allison-Bunnell 2002). When organized fire suppression and logging of large pines disrupted this historic ecosystem, young firs were able to take over. Many dense fir forests east of the Cascades still have remnants of huge ponderosa pines that were logged long ago. Old ponderosa stumps can be identified by a core of sound pine pitch-wood—light colored and smelling of fresh pitch when carved with a knife.

Pitch-filled stumps often preserve a sequence of scars from ancient fires. One stump from a tree felled in 1906 near Hamilton, Montana, had scars from thirty-one fires between about 1545 and 1883 (Gruell and others 1982). Other nearby stumps and live trees had scars from twelve additional fires during that period. Also, a thick layer of ponderosa's distinctive orange bark, complete with puzzle-shaped bark flakes, is often found by scraping away litter at the base of old stumps.

Ponderosa historically prospered on south- and west-facing slopes and other sites where tree litter and grass were dry and combustible for long periods during most years. Ponderosa virtually ensured frequent burning by providing its own light fuel in prodigious quantities. Any homeowner in a ponderosa forest can attest to this after gathering 1 to 2 tons per acre (2 to 4 tonnes per ha) of shed needles and cones from around the house and outbuildings each year. This material is the ideal fuel that fire scientists use for experimental burning in combustion chambers!

Frequent burning triggered pitch flows into the base of ponderosa pine trees, which in turn produced durable trunks. Thus, snags of old-growth ponderosa pines commonly remain standing for 50 to 150 years and provide excellent habitat for woodpeckers and a variety of cavity-nesting birds and small mammals. Conversely, large second-growth ponderosas have seldom experienced fires; thus they rot and fall within a few years of dying.

Black bears like large old ponderosas for

Opposite: Giant old ponderosa pine in a pasture near Arlee, north of Missoula, Montana, in 1933. (U.S. Forest Service, Region 1 photo)

glacier lilies with ponderosa pine needles

climbing "exercises," their claw tracks often extending a dozen feet or higher up the smooth, pillarlike trunk and numerous scratch marks etched into the tree's charred, hardened fire scar.

Human History

There are at least 200 published references to specific Native American uses of ponderosa pine (Moerman 1998). Native peoples used ponderosa stems and limbs as a building material and for firewood; they used the gum as a salve or ointment; needles were boiled to make a solution used for cough and fever; seeds were eaten; dried pitch was chewed as gum; needles and fine roots were employed in making baskets; trunks were fashioned into dugout canoes; pitch was used as a glue and a waterproofing agent; and twigs served as twirling sticks in making fire.

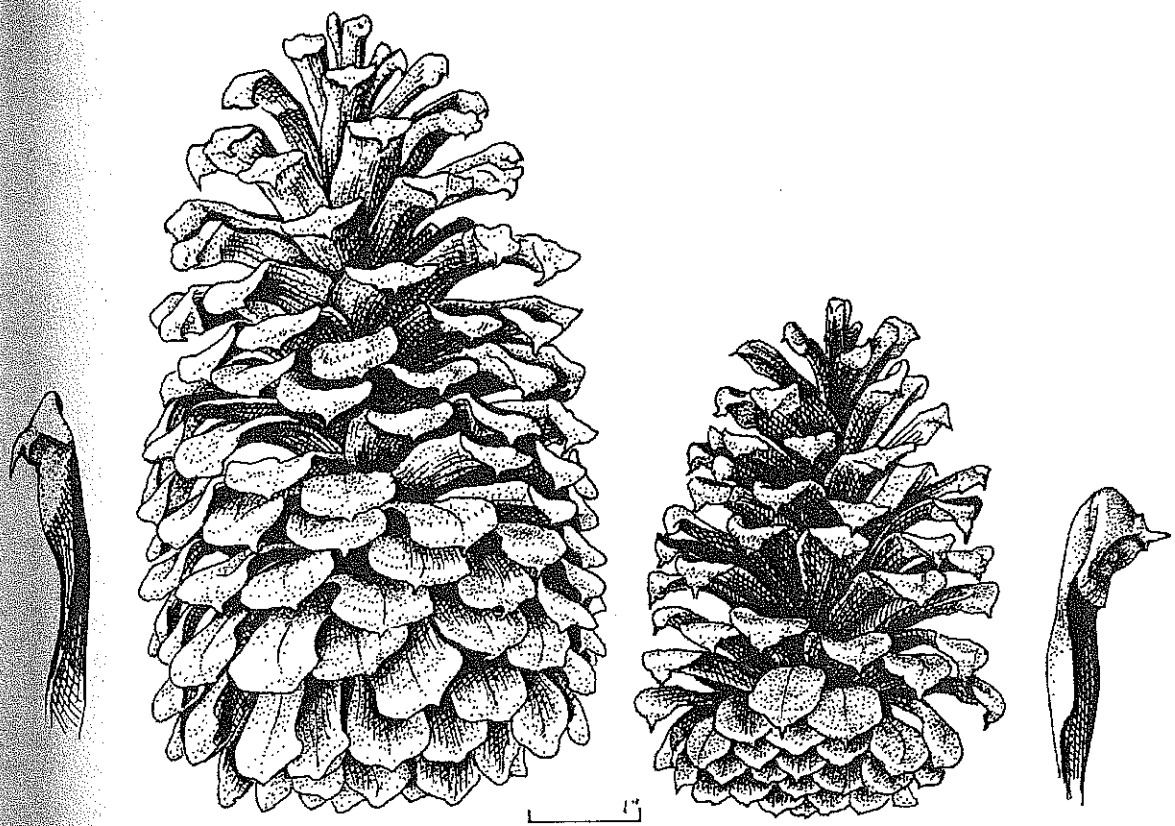
Direct evidence of one widespread use of ponderosa pine by aboriginal peoples can still be seen today: bark-peeling scars on old-growth trees. Women would harvest the tree's sugar-rich inner bark, or sap layer, in late spring by removing the outer bark with axes and sharpened poles. As a result, a large oval peeling scar extended several feet up one side of the trunk, from the starting point at 12 to 24 inches (30 to 60 cm) above the ground. The inner bark layer (appearing like wet felt) could be eaten directly or used to sweeten and help preserve foods being dried or cooked. Trees were not girdled or killed by bark-peeling, and the cameo-shaped scars—which are now smaller than their original size due to healing—can be seen at the Swan Valley Ecosystem Center at Condon and Indian Trees Campground at Sula in western Montana and along major tributaries of the Salmon River in Idaho. More than

JEFFREY PINE *(Pinus jeffreyi)*

Jeffrey pine is an intriguing cousin of ponderosa pine that mainly inhabits the mountains of California but also extends north throughout much of the Siskiyou Mountains in southwestern Oregon, where it is abundant along US 199 south from Cave Junction. In the northern part of its range—the Klamath and Siskiyou mountains—Jeffrey pine is largely confined to infertile soils derived from rock rich in heavy metals (serpentine, etc.) that impede the growth of most conifers. In most of its range in California, Jeffrey pine tends to grow at higher elevations or on frostier sites than ponderosa tolerates.

Jeffrey pine's appearance is very similar to ponderosa's. The cones provide one obvious distinction. Cones of Jeffrey pine are 5 to 10 inches (13 to 25 cm) long, which is larger than ponderosa cones, and are not prickly when handled since the prickles curve inward instead of pointing outward.

One subtle difference is that the bark of old Jeffrey pines tends to be reddish-brown, in contrast to the orange- or yellow-brown bark of ponderosas. Jeffrey pine bark often has a vanilla- or pineapplelike fragrance in warm weather. The two pine species can hybridize but normally do not, because Jeffrey pine releases pollen significantly later than does ponderosa.



Left: Jeffrey pine cone; right: ponderosa pine cone

100 individual bark-peeling scars examined on ponderosa pines in the Bob Marshall Wilderness, Montana, dated from 1665 to the early 1900s (Östlund and others 2005).

Northwestern ponderosa pines were the first forest trees encountered by pioneers on the Oregon Trail who had struggled for months to cross sagebrush deserts in what is now Wyoming and southern Idaho. When these beleaguered pilgrims finally reached eastern Oregon's Blue Mountains, their diaries chronicle the beauty and promise embodied in the first sentinels of western forest (Evans 1990). The big, tall, full-crowned ponderosas they beheld were associated with necessities that had been scarce or nonexistent during most of their journey: clear streams, green meadows for pasture, shade and shelter, firewood, and a source of lumber for building homesteads.

Throughout much of the inland West, old-growth ponderosa pine became the major source of lumber for building settlements and even for railroad ties in the nineteenth and early twentieth centuries, because of its widespread accessibility and good quality. By the mid-twentieth century, much of the historic old-growth ponderosa—termed "yellow pine" in the lumber trade—had been replaced by dense stands of young ponderosa and fir that had grown up in the absence of thinning fires. Paradoxically, the dark-barked young ponderosas, termed "bull pine," are of low value for lumber, because boards sawn from them readily warp and split.

Some foresters and landowners with ponderosa pine forests have become interested in mimicking historic conditions (Arno and Fiedler 2005). This involves thinning and using selective harvests to create open stands of vigorous trees of many ages, including large ponderosas. Where possible, prescribed fire is employed to reduce ingrowth of small trees (especially firs) and accumulations of fuel. Burning also recycles nutrients beneficial for biological diversity and wildlife forage. A modest but sustainable quantity of high-value yellow pine logs can be produced using this kind of "restoration forestry," which simulates the primeval ponderosa pine ecosystem.