JIM WEST / ALAMY

# Ancient Wonders

## Bristlecone pines are living records of the distant past | By Eric Lucas

It's a chalk-white universe around me—the dirt, the dust, the dolomite stones, the prickly phlox, the fierce sunlight at 10,000 feet on an unnamed desert peak that happens to be part of the White Mountains. The mountains were named for the dolomite, a type of limestone, but there's an additional reason the moniker is apt: The color white is sometimes associated with age, and I am in the realm of one of Earth's oldest living things: bristlecone pines.

Gnarled, stiff-needled denizens of incredibly harsh environments in the Great Basin, these pines can live more than 4,500 years. The oldest recorded living bristlecone, nicknamed "Methuselah," is approaching 5,000 years old. To put that in perspective, it dates back farther than the Egyptian pyramids and was already more than 2,500 years old at the time of Christ.

Methuselah holds sway in a grove of multi-millennial trees—stoop-shouldered, crooked-jointed, typically just 15- to 30-feet tall—on a nondescript ridge in the Inyo National Forest's 45-square-mile Ancient Bristlecone Pine Forest.

Several peaks in the White Mountains, includng the approximately 10,600-foot one on whose slope I'm standing, are in the forest, which is located east of Mammoth Lakes, California. Were nonbiologists to pick a place for living things to achieve astounding age, this range would not be it. In the kingdom of the ancient pines, summer sun sears the hillsides and raises the temperature above 90 degrees. Clouds are distant rumors; rain almost a legend. Dust paints the air the hue of dry grass. In winter, temperatures plummet below zero; winds howl; skiffs of snow scurry over bare ridges into protected gullies, leaving most of the ground as dry as it is in summer.

There are great mysteries here, such as how the bristlecone—*Pinus longaeva*—achieves great age, especially in these severe conditions. I plan to explore that question further during this July visit, but right now I'm in search of something more tangible—a single piece of dead bristlecone wood that might fill in a specific scientific gap.

Not just any garden-variety dead wood, but wood more than 8,000 years old. Wood so ancient, it represents the same time span as more than 300 human generations and far predates the oldest above-ground, still-standing human structures. Wood that's a key piece in the puzzle that has been the lifetime work of the world's leading expert on old bristlecones and tree-age dating, a scientific pursuit known as dendrochronology.

Tom Harlan is that scientist, a University of Arizona researcher who has been coming here for decades to compile a complete tree-ring map of the history of bristlecones, going back more than 13,000 years. He is continuing research started after World War II by a scientific legend, Edmund Schulman, another UA professor. Schulman was a renaissance scientist who combined astronomy, climatology and dendrochronology in his work. It was a group led by Schulman who found, up here in the Whites, the Methuselah tree.

Schulman also studied what is generally considered to be the largest bristlecone, the Patriarch tree, about 37 feet in girth. The Patriarch, about 1,500 years old, is also surprisingly tall for a bristlecone, at 41 feet, although a few of the pines have reached 60 feet in height.

To protect the Methuselah tree from vandalism, it is not identified, and its height and girth are not listed, but it is located within the Ancient Bristlecone Pine Forest's Schulman Grove, which can be viewed via a four-mile-loop hiking trail from the under-construction Schulman Visitor Center. The Patriarch tree, which is identified with a sign, stands in the Patriarch Grove, about 12 miles north of the Schulman Grove and reached via a gravel road. The pine forest is usually open to visitors Memorial Day into October, depending on the weather.

PHOTOGRAPHER / ALAMY

Above and opening spread: Otherworldly looking bristlecone pines, known for their longevity, are found in challenging environments such as at high elevations in California's Inyo National Forest. The tree above lived to be approximately 3,000 years old.

After half a century of tramping around in the Whites, Harlan himself looks somewhat like the trees—dusted ivory skin and hair, spindly limbs, knobby joints. By starting with known tree-ring records from living pines, and identifying, comparing and cross-matching ring patterns with those of dead ones, as well as using carbon dating for the oldest dead-wood samples, he's compiled a tree-ring chart stretching back past 11,000 B.C. Good-growth years mean wide rings; slow-growth years, narrow; harsh years, with almost no growth, nearly undetectable rings.

But there's a roughly 150- to 200-year gap, from around 8,500 years ago, that might be closed if we

can find a piece of wood from that period. So far, no one—not Harlan, not his wife and partner, Annita Harlan, who is an archaeobotanist, not any of the innumerable grad students, scientists, hobbyists and such who have helped him over the decades—has found a piece of wood whose tree rings span that gap.

"A few years ago, one group found a standing snag that dated back more than 8,000 years and was about 1,500 years old when it died," Harlan recalls. "Imagine that: This tree lived more than a millennium—and after it died, it stood there for 7,000 years. Seven thousand years! But it was just barely outside the gap years we need to find."

I'm adding my efforts to the search for the missing link—scrambling up and down steep scree slopes on a sun-bathed ridge with fellow Seattleite Bob Hamilton, who is a chemical engineer and an old friend of Tom Harlan's. Hamilton also happens to be one of my Seattle neighbors, and he arranged my participation in this excursion. Joining us in the quest is Iain Robertson, a tree-ring researcher and geography professor at Swansea University in Wales, who comes here each summer. "This is the best place in the world to study tree rings," he says.

We're seeking bits of dead ground wood that strike us as old, and, under a special Forest Service permit, taking a few core samples and sawing off pieces to haul back to Harlan's summer lab on the mountain's flanks.

Researchers rarely core all the way into living trees these days, because it opens a pathway for possible pest infestation, and there is little point, save to confirm what we already know: that the pines live thousands of years. Besides, taking samples is very challenging, as I learn while coring the old dead spars. Bristlecone wood is exceedingly dense, saturated with old resin and as tough as oak. Polished up, it looks like dark teak; you cannot scratch it with a fingernail.

We photograph all our samples, before and after sawing them, and use a GPS device to record the exact location. I pose for a picture beside what I think is an incredibly ancient, long-limbed old tree. Roberton surveys it professionally. "I estimate that it's about 3,000 years old," he says.

We break for lunch in a shady gully, enjoying the scenic vista of conifers and dolomite stretching hundreds of miles, with golden eagles and white-throated swifts soaring above the trees. I discover that Harlan knows of trees older than Methuselah, trees he is certain surpass 5,000 years, but he has told no one else where they are.

Scientists are well aware that unprincipled souvenir seekers ripped pieces off the Methuselah tree after it was first found, and are mindful of the sad tale of the erstwhile oldest tree, nicknamed Prometheus, which was felled elsewhere in the Great Basin by a geologist in 1964. Afterward, researchers

## Other Ancient Trees

The bristlecone pine is one of the many ancient tree species found in the western Lower 48 states. In fact, until the 1950s, researchers thought **sequoias** were the oldest tree species still in existence. An elder sequoia can reach 3,500 years of age. These majestic trees live in the Sierra Nevada, in places such as Sequoia, Kings Canyon and Yosemite national parks, where rain and snow provide ample moisture, and temperatures are moderate. Sequoia National Park supervisory ranger Matt Fagan says that with ample moisture and a good site, a young sequoia can surpass 100 feet in height in 20 years. Once it has established its canopy position, it spreads out and aims for the centuries.

The world's "biggest tree"—the General Sherman, based on trunk volume of more than 52,500 cubic feet—is one that has done exactly that. The 275-foot-tall General Sherman is estimated to be around 2,500 years old. By bristlecone standards, that's just middle age—but it's still ancient by human perspectives. Numerous other ancient sequoias thrive in the groves of the Sierra national parks, including the tallest sequoia, an unnamed 311-plus footer in Sequoia-Kings Canyon. You can get to the parks from the Alaska Airlines gateway of Fresno and, for Yosemite, also from Mammoth Lakes. For more information on the national parks, visit www.nps.gov/seki or www.nps.gov/yose. Impressive sequoias also grow in several California state parks; www.parks.ca.gov.

The sequoias' cousins, the **coast redwoods**, are ancient, too, living well past 2,000 years. Redwoods' adaptation to their unique environment has made them some of the world's tallest trees, frequently surpassing 300 feet—which is where their foliage can extract moisture from the coastal fogs that pile up on Northern California's coast ranges. The world's tallest tree is believed to be a 379.1-foot coastal redwood named "Hyperion," located in Redwood National Park. Another good place to see redwoods is Humboldt Redwoods State Park. You can reach the parks from the air gateways of Medford, Oregon, or San Francisco. For more information, visit www.nps.gov/redw/index.htm and www.humboldtredwoods.org.

Northwest **Douglas firs, hemlocks and western red cedars** can also reach great age and height—several hundred to 1,000 years old, and 200 to 300 feet tall—though the oldest and biggest were logged in the late 19th century. The Grove of the Patriarchs on the southeast side of Mount Rainier National Park in Washington state is a good destination for ancient-tree viewing, and the grove has all three types of conifers. Seattle and Portland are the air gateways. For more information, visit www.nps.gov/mora.

On Vancouver Island, Canada, the **Sitka spruce** can reach more than 800 years of age and attain more than 300 feet in height. Some of the finest Vancouver Island groves are in Carmanah Walbran Provincial Park, Pacific Rim National Park and MacMillan Provincial Park, whose Cathedral Grove is an excellent mixed stand of old-growth spruce, cedar, hemlock and fir, comparable to the Grove of the Patriarchs at Rainier. Victoria is the air gateway; for more information, visit www.bcparks.ca and www.pc.gc.ca.

In the Rocky Mountain region, **aspen-clone** colonies—comprising genetically identical trees with same root system, and therefore considered a single genetic entity—are often cited for their longevity. Though each tree stem within a colony may be at most around 120 years old, the overall entity may be up to 10,000 years old. Arizona, Colorado, Idaho, Montana, Nevada and the Canadian province of Alberta all have aspen-clone networks. A good place to see aspens is Waterton Lakes National Park in Alberta. Calgary is the air gateway; www.pc.gc.ca. —*EL*

© 2011 Starwood Hotels & Resorts Worldwide, Inc. All Rights reserved. SPG, Preferred Guest, Westin and their logos are the trademarks of Starwood Hotels & Resorts Worldwide, Inc., or its affiliates.

50 HILLSIDE DRIVE, MAMMOTH LAKES, CA

FEATURING AN EXCEPTIONAL PENTHOUSE IN A PRIVATE, GATED ENCLAVE IN SEATTLE'S HISTORIC HARVARD-BELMONT NEIGHBORHOOD – ONLY FIVE MINUTES FROM DOWNTOWN.

OPEN DAILY Noon to 5PM PRICED FROM *$995,000 to $2,350,000*

FOR MORE INFORMATION PLEASE CONTACT

Carrie DeBuys & Melissa Camp

PHONE 206.834.6419

1185 Broadway East, Seattle WA

*www.HarvardandHighland.com*

Windermere

PRICING AND AVAILABILITY SUBJECT TO CHANGE.

## Visit California Wine Country

A FIRST-CLASS JOURNEY...

PASSPORT

*to Dry Creek Valley®*

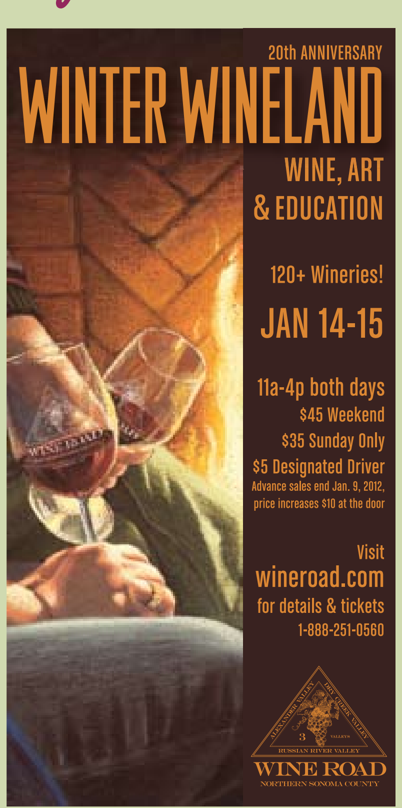
APRIL 28 & 29

SELL OUT EVENT

Get your tickets early!

ON SALE FEBRUARY 1, 2012

**wdcv.com**



discovered that the bristlecone had been more than 4,900 years old.

I ask Harlan if there might be living bristlecones older than 6,000 years, 7,000 years, and he shrugs amiably. In the UA's Laboratory of Tree-Ring Research in Tucson, where he was a research associate until semiretiring to become a part-time research technician in 1990, there are old core samples collected by Schulman that have not yet been dated, due to lack of funding. Harlan is using his own funds to work his way through them.

But, he notes, "We'll never know how old the oldest bristlecone is. For one thing, a tree that old, the center eroded away by wind-blown sand long ago, and what's still living could just be several strips of bark. We couldn't core our way back to year one, even if we wanted to try. It's gone."

Interestingly, places such as our lunch spot—a slight depression in the earth where rainwater might collect—and places with better soil, do not necessarily hold older trees. Bristlecones have engineered a longevity strategy that confounds human expectations. The harsher the circumstances, the longer the pines seem to live.

Researcher Anna Schoettle, a plant ecophysiologist with the U.S. Forest Service, confirms that given ideal growing circumstances, bristlecones have ... shorter lives.

"If the tree is in an area where it grows faster, it will often be shorter-lived—maybe 1,000 years," she says.

Schoettle is studying bristlecone longevity factors. For instance, the trees hold their needles for as long as 30 years, compared to three to five years for most pines, and the more rugged the environment, the longer bristlecone needles live. The bristlecones favor sites where fire is seldom a problem—trees in the Whites are so widely spaced that lightning may kill one tree, but rarely will fire spread. And since so few other plants live here, the bristlecones have little competition.

Most of all, they adapt to prevailing conditions, whatever they are. It's an axiom of biology that plants must grow or die. But at 10,000 or more feet in the White Mountains, a bristlecone will encounter, over the centuries, some brutal years of extreme drought or severe cold. How does it cope?

The answer is astounding. In an incredibly bad year, bristlecones meet the biological imperative to grow or else, by laying down an annual growth ring consisting of a single cell. Yes, *one single cell* in a whole year. Researchers detect it only under magnification.

"The conditions these trees grow under may seem harsh by our standards, but in fact they are protective by their standards," says longevity expert Dr. Stephen Coles, a University of California, Los Angeles gerontologist who studies human supercentenarians—people who have lived past 110 years.

“In a business where so much can go wrong, our broker makes sure a lot goes right.”

Senior Living
Real Estate
Construction
Education
Banking
Recreation
Manufacturing
Transportation

At Propel Insurance, we’re proud to partner with many of the region’s leading construction companies, providing the right kind of coverage when everything’s on the line. With decades of experience in insurance, surety and risk management, our construction experts understand the challenges you face and are highly-skilled at managing complex issues, overcoming project obstacles and streamlining the entire process. Find out more about a risk management approach that can keep you well-protected and building toward your goal at **propelinsurance.com**.

**Find your momentum with Propel.**

**1-800-499-0933**
**www.propelinsurance.com**

Coles knows of about 90 such humans, and has personally interviewed many of them. He has also visited the White Mountains and hiked in the Schulman Grove, in awe of the bristlecones’ age and the way they have adapted to formidable climatic conditions.

Coles calls the idea that molecular biologists might distill some magic youth potion from bristlecones, “silly,” but he is fascinated by their adaptations to their environment. Senescence—aging—seems to be caused in part by cellular mutations triggered by solar radiation. How do bristlecones, which live at high altitudes more subject to UV radiation, fend off such damage? Especially when their critical growth engine, the needles that perform photosynthesis, live up to 30 years? No one knows. Paradoxically, needle longevity appears to be a factor in the trees’ long lives yet it should also make the trees more susceptible to harmful UV-related mutations.

Coles points out that his research has not identified any specific keys to the long life span of supercentenarian humans, either, but he has noticed that quality of long life is rarer than long life itself. “I interviewed a 114-year-old woman in Florida who could complete my sentences—that’s very rare,” he says. “Most people that old show deteriorated faculties.”

One could ask whether the very oldest bristlecones are functionally impaired, like the average supercentenarian human. A 4,000-year-old tree may have only one living strip of wood on the lee side of a largely dead trunk; that strip may support just one living branch.

In addition, trouble may be coming to the bristlecone kingdom. A nonnative fungus—introduced to the western United States by infected seedlings from Europe in the early 1900s—has been killing high-elevation pines as it works its way south from the Northwest. It's not known when it might reach the Great Basin bristlecones. It's also not known whether it will damage the venerable trees or whether they will tolerate this latest threat, to the further fascination of scientists.

Climate change also may pose a challenge to the bristlecones ... or it may not. A 2009 study by the University of Arizona’s Matthew Salzer and other researchers showed that the highest-elevation bristlecones grew more rapidly during the last 50 years of the 20th century than they had in the prior 3,700 years.

Salzer theorizes that global warming has a greater effect on the growth of trees at higher elevations than on trees in dense

*Find Your Diamond in the Pearl.*

*Located in the Pearl District:* 320 NW 10th Avenue Portland, Oregon 97209
*phone:* 503.227.3437 or 800.205.9951 www.JudithArnellJewelers.com

*No Sales Tax in Oregon!*

forests lower on the mountains. The higher-elevation trees are used to colder temperatures, so these trees are more affected by temperature increases caused by global warming, he says. Trees lower on the mountains are already used to warmer temperatures and are not as affected.

It may take thousands more years to determine if faster growth means a longer or shorter life span for the bristlecones.

The recent study was one narrowly focused snapshot in a very long panorama. My efforts with Harlan in the White Mountains, scouting ground that has never before been checked, yields wood no older than 7,000 years, thus failing to fill in Harlan's missing link. But—7,000 years!

"If I take the paper graph on which my long-span chronology is recorded, and spread it out, it circles my living room," Harlan says. "On that scale, my life span is just a couple inches." He holds his fingers barely apart to illustrate.

The researcher—who has studied ancient trees around the world—including Alaska, Argentina, Australia, Chile, Finland, Morocco, Mexico and New Zealand —would like to fill in the approximately 200-year gap not to boast some big number, but simply to reach completion and, perhaps, a bit more understanding. Not the concrete, conclusive, quantified understanding that has so often been the subject of human endeavor, but an understanding that might better be called appreciation.

"I don't want to be part of the human imperative to single out the biggest, oldest, tallest, longest whatever," Harlan says. "There's always much more that we don't know, than we do."

At least I know I have stood next to a living tree that's around 3,000 years old. It likely started growing during the Zhou Dynasty in China and before or during the reign of biblical King Solomon. I ran my hands along its smooth wood, scalloped by the wind; drew in its resin scent; sheltered against the sun in its shade. I'm sure it has centuries, and centuries, to go. ■

*Eric Lucas writes from Seattle's Ballard neighborhood.*

---

*Alaska Airlines (800-ALASKAAIR, alaskaair.com) serves Mammoth Lakes daily via flights operated by Horizon Air. For more information on the Ancient Bristlecone Pine Forest, go to www.fs.usda.gov/inyo, and click on the "special places" link. For more information on attractions and activities in the Mammoth Lakes area, including Yosemite National Park, go to visitmammoth.com.*