

Scientists discover redwoods' resiliency in Fritz's Wonder Plot

Rapt with awe under the cool canopy of Northern California's majestic, 1,000-year-old redwoods, visitors may wonder what could possibly have motivated early Americans to chop down these giants without restraint.

Did the expanse of forests seem infinite? Were the settlers desperate for work and security? Were they unaware of how long it takes an undisturbed forest to grow into cathedral-like grandeur?

In fact, they couldn't have known much about the regeneration of a logged, old-growth redwood forest. In the recorded history of the world, the process had never been observed. Today, however, scientists are well on their way to

understanding California's redwood forest regrowth because of the foresight and efforts of Emanuel Fritz, the late UC Berkeley professor of forestry.

In 1923, Fritz and a colleague, Woodbridge Metcalf, happened upon a thicket of young redwoods in a forest that had been harvested in the 1860s, about 100 miles northwest of San Francisco.

"We could hardly believe what we saw," Fritz later wrote.

The stand was dense; the volume high. Fritz and Metcalf secured the 1-acre grove to study second-growth tree and forest development. Fritz believed it to be "the best and oldest second-growth forest in

the entire redwood region." He called it the Wonder Plot.

Decades of data

Each decade, Fritz counted trees, mapped their locations, measured the tree trunk diameter at breast height, and estimated the average height and total volume of the stand in board-feet. He found that, while the number of trees in the plot decreased, the average tree diameter, estimated average tree height and estimated stand volume increased.

In the 1920s, many timber companies did not see value in their cut-over lands. However, Fritz was an advocate of sustainable second-growth of redwood trees for wood production. He understood that old-growth was a finite resource, and he set up his research plots knowing that in 30 to 50 years, foresters would be asking questions about second-growth management. His study helped demonstrate the remarkable regeneration potential of the species.

"I have been on the plot nearly every year since 1923 and hope to make what will likely be my last measurement in

1963," Fritz wrote in 1960. He actually took measurements in the plot until 1983, when he was 97 years old. After Fritz died in 1988, his legacy was carried on by researchers who have recorded the data every decade since. The collective study has provided one of the most complete descriptions of how an older second-growth forest matures.

Foresters preserve research plot

Ownership of the Wonder Plot has changed many times. When Fritz first took measurements, Casper Lumber held the deed. The plot was later transferred to Union Lumber and then Georgia-Pacific. Each time the Wonder Plot changed hands, Fritz maintained a rapport with the foresters and had access to the plot. In deference to the dedicated researcher, foresters never took trees.

In 1975, Georgia-Pacific permanently protected the Wonder Plot for the purposes of research on redwood growth and yield. In 2003, ownership transferred to the Conservation Fund, and then the California state park system as part of Mendocino Headlands State Park.

Georgia-Pacific foresters, many of them graduates of UC Berkeley's forestry program, collected data on the plot every 10 years until forestry professors John Stuart and Jerry Allen of Humboldt State University took over the task in 1995. In 2005, Greg Giusti became the research leader.

"I didn't want the chain to be broken," said Giusti, UC Cooperative Extension forest advisor in Mendocino and Lake counties. "I recruited volunteers from Save the Redwoods League, the Mendocino Land Trust and California State Parks to maintain the research continuum."

Along the Big River

The Wonder Plot is in the Big River watershed, in the central section of California's Coastal Redwood forest belt. There are reports that the Big River's name came not from the size of the waterway, but from the size of the trees originally lining its banks.

"It is no surprise that river logging came to the watershed soon after the California Gold Rush," Giusti said. "These guys would float down the river as far as they could go — drag logs to the river and float them down to the coast."

The remarkable old-growth of the Big River's lower terraces and hillsides was quickly cleared and transported by water to the new town of Mendocino, where it was milled to produce the lumber needed in boom-era San Francisco.

Giusti said it is unlikely that deeds to the land had been established at that time. "It was just the Wild West."

There is one asterisk on the assertion that humans maintained a hands-off policy in the Wonder Plot.

"In the 1990s, a number of trees blew down during a storm," Giusti said. "Foresters went in and took those logs. As an ecologist, I think that's too bad. But no one has ever



Emanuel Fritz, founder of the Wonder Plot, rode a lumber load on the Meadow Valley Grays Flat lumber tramway, circa 1926.

Photo: Fritz-Metcalf Photographs Collection, Marian Koshland Bioscience and Natural Resources Library, UC Berkeley (www.lib.berkeley.edu/BIOS).

gone in and cut out trees, and no one has removed fallen trees since then."

Dense vegetation affects methodology

The nature of the Wonder Plot has provided an invaluable opportunity to study the development of a stand from a known point of harvest to the modern era. But the modern era hasn't offered many improvements for scientists in data collection. In an age of satellite imagery and GPS mapping, Giusti conducted the 2005 survey using a reproduction of the 1923 plot map hand-drawn by Fritz.

"The forest canopy is so dense that you can't use electronic devices," Giusti said. "The trees block the satellite signal."

Even a high-technology tool commonly used to measure tree height, a hypsometer, was foiled by the Wonder Plot's dense vegetation.

"We relied on old-fashioned measuring tapes and clinometers. All the new electronic devices intended to provide data points with a click of a button were impossible to use because of the density of the trees."

Giusti's 2005 survey revealed some changes since the last review of this patch of forest. He found that 70 of the original trees counted in 1923 were still standing, and he recorded 17 new saplings. "This represents a significant drop from the 112 trees on the plot in 1995, many of which were lost in a storm event in 1998," Giusti said.

The 1998 windstorm created openings in the plot's dense canopy that allowed the establishment of a new generation of redwoods for the first time in more than a century.

Average tree height in 2005 was 198.5 feet, and average diameter at breast height was 39.9 inches. Stand volume remains roughly equivalent to the 1963 measure. The Wonder Plot would produce four times the amount of board-feet expected from an average stand, a volume Fritz called "astro-nomic, even for California redwood."

Understanding forest habitat

In addition to understanding wood production in the Wonder Plot, Giusti is interested in studying the unique habitat elements associated with old-growth forests. For example, in nearly 150 years, none of the second-growth trees has developed trunk hollows common in older redwood stands in Mendocino County, he said.

A still more enigmatic old-growth forest habitat — reiterative branches with epiphytic plants — is also absent in the grove. Reiterative

branches are limbs that over generations of exposure are broken, twisted or overgrown into a sort of platform. Over time, dust and duff accumulate on the branches, creating a soil bed high in the canopy on which moss mats, ferns and other foliage grow. Populations of clouded salamander living high off the ground have been found in such old-growth habitats.

"We know very little about the development of these treetop habitats. It's a whole new world," Giusti said. "But that's something else we hope the Wonder Plot will reveal in the coming decades."

The data will be invaluable to California redwood conservationists, such as Save the Redwoods League, the Conservation Fund and the Redwood Forest Foundation. In Mendocino County alone, there are more than 90,000 acres of cut-over land owned by nonprofit organizations.

"They want to reestablish the primordial forest," Giusti said. "The Wonder Plot gives us some insight on how a cut-down redwood forest will recover. We have a baseline for recruiting old-forest characteristics and the grandeur that was lost by rapid cutting in the 20th century. The Wonder Plot serves as an example of what we will have over time."

And that example is promising. Giusti uses a highly technical term to describe the Wonder Plot.

"It is *über* cool," he said. "The trees are huge, but they are just babies at 100, 120 or 150 years old. They have the potential to live for a millennium. You already sense that cathedral-like quality when you walk in. The air changes. The way noise moves through the forest is different. It's starting to feel like an older forest."

— Jeannette Warnert

The Fritz plot research team took a lunch break from measuring trees in August 2005; UCCE forest advisor Greg Giusti leaned against a redwood.