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Saguaro sayonara

Researchers try to explain decline of Rincon stands

By Jim Erickson
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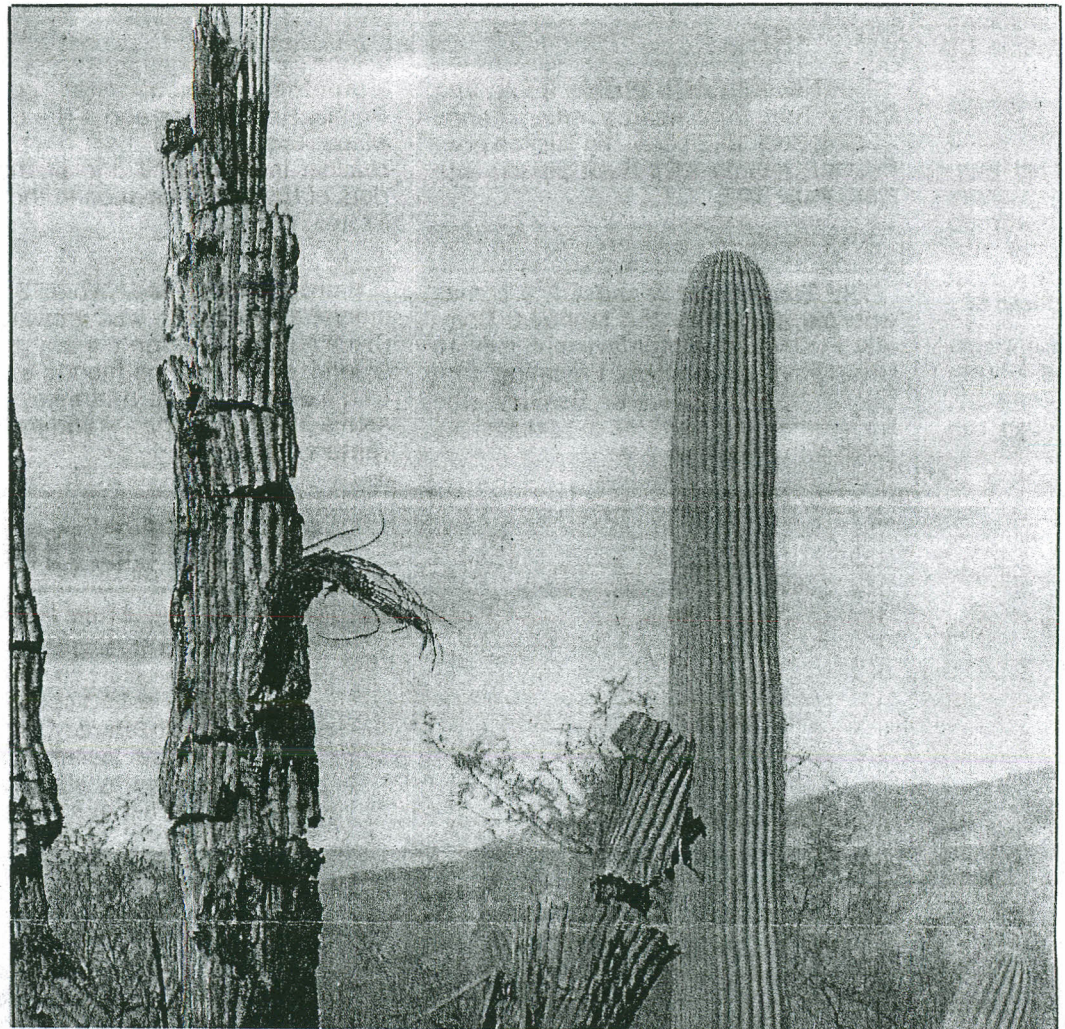
Researchers have struggled to explain the thinning of the Rincon Mountains saguaro forest since the decline was first noticed in the late 1930s.

Winter freezes, capricious monsoons, livestock grazing, wood-cutting and a lack of pollinators have been advanced as possible explanations for the 75 percent reduction in mature saguaros at Saguaro National Monument's Rincon unit, east of Tucson, over the last five decades.

Recently, air pollution from a copper smelter in San Manuel and increased ultraviolet radiation because of ozone depletion were added to the list.

But early results from a chemical analysis of saguaro tissue suggest that smelters aren't the problem, and a test of the ozone-hole hypothesis — a makeshift saguaro tanning booth that bathed two of the Rincon cacti in ultraviolet radiation — was suspended recently because results were inconclusive.

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Boston University biologist Kate Lajtha sampled Rincon saguaros and looked for plant-damaging metals known to be released by copper smelters. The San Manuel smelter is about 30 miles north, and upwind, from the Rincon saguaros.

Levels of lead and cadmium, the smelter metals most likely to damage cacti, were "extremely low" in the Rincon saguaros, said Lajtha, an assistant professor of biology. Tests for the presence of copper, nickel and antimony are still in progress.

"The levels of trace metals analyzed so far are so low — much lower than the levels known to damage plants — that we feel they're not responsible for the decline," Lajtha said during a recent visit to her saguaro test-plots in the Rincons.

"In fact, one of the healthiest populations of saguaro cacti we have ever seen is about two miles directly downwind from the (San Manuel) smelter, so I think it's very highly unlikely that this is the problem," she said.

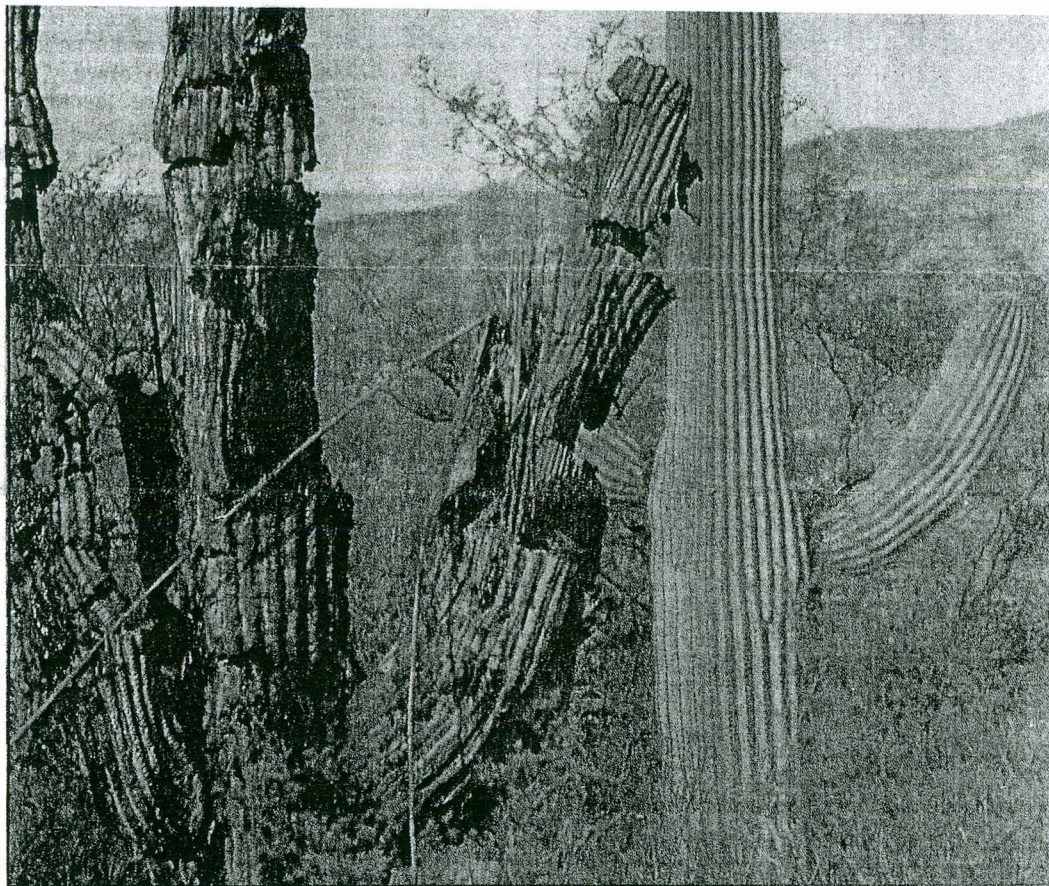
Lance Evans, a biologist with Manhattan College in New York City, suggested last year that a thinning of the protective ozone layer, and a corresponding increase in levels of harmful ultraviolet radiation making it through the atmosphere, may be killing off the giant cacti.

To test the idea, Evans set up an ultraviolet lamp alongside two Rincon saguaros last August, switched it on, and periodically checked tissue samples for damage.

The experiment, funded in part by the National Park Service, was suspended in April because "the results he was providing to us were pretty inconclusive," said Meg Weesner, chief of the monument's division of science and resource management.

"After review of his research design by several scientists, we decided to turn off the lamp," Weesner said. "He didn't really know how much (ultraviolet radiation) he was treating them with, and he had no information on existing UV levels in the monument.

"We didn't think the information we gained



A.E. Aralza, The Arizona Daily Star

Saguaro population in the Rincon section of the national monument is dwindling

was worth the destructive sampling of two saguaros," Weesner said.

Saguaro National Monument was established in 1933, primarily to preserve the impressive saguaro stands there. The two monument districts — the Rincon Mountains district and the Tucson Mountains district — are about 30 miles apart, separated by the city of Tucson.

About 700,000 people visit the 83,574-acre monument each year.

In the late 1930s, researchers first noticed that the Rincon saguaros weren't producing enough seedlings to maintain a steady population.

From the turn of the century through the early 1960s, very few saguaro seedlings survived in the Rincons, according to U.S. Geological Survey botanist Raymond Turner, who has studied saguaros for 36 years.

What's left of the mature Rincon saguaro for-

est will be gone early next century, though a new generation has gained a foothold and will one day rise up to replace those dying giants, Turner said.

Through the years, the most popular explanation for the decline has been that increasingly frequent winter freezes killed off saguaro seedlings and older saguaros.

Recently several researchers have suggested that "epidermal browning," the scabby brown patches seen on many mature Rincon saguaros, hastens the demise of older cacti by weakening them and making them more susceptible to freeze damage and other environmental stresses.

In 1989 Park Service botanist Ken Stolte, who works with the agency's air-quality division, suggested a link between air pollution, epidermal

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Saguaro

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browning, and the decline of the Rincon saguaros.

Stolte's hypothesis was that some airborne pollutant degrades the saguaro's waxy, protective outer coating, the cuticle. Damage to the cuticle accelerates the spread of epidermal browning, which in turn reduces the plant's vigor and makes it vulnerable to further attacks, he suggested.

"I do think that freeze is the Grim Reaper, but it appears that air pollution has first lowered their winter hardiness, setting them up and predisposing them to that fate," Stolte said at the time.

But preliminary results from Lajtha's trace-metal study, funded by the Park Service, suggest to her that "air pollution does not provide a link between browning and the decline."

Said Weesner: "Epidermal browning leads to an unhealthy appearance, but there is no real evidence that it leads to the death of a saguaro."

This summer Lajtha and several graduate students are conducting a follow-up study to get a better understanding of epidermal browning in saguaros.

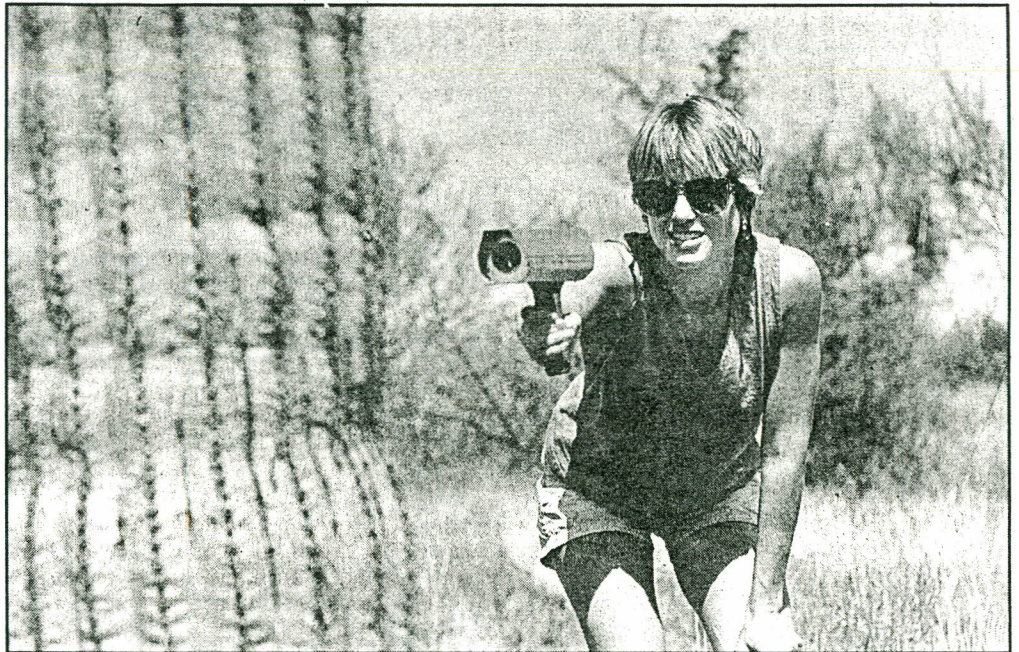
Is epidermal browning more severe in the Rincons than in other saguaro populations, as some researchers suspect? Is the extent of browning indicative of the general health of the plant? What causes it?

To answer these and other questions, the researchers will visit 10 sites throughout the range of the saguaro this summer. They will assess the extent of browning on saguaros of various ages and gauge their health by measuring photosynthetic rate, the rate of water loss, and surface temperature.

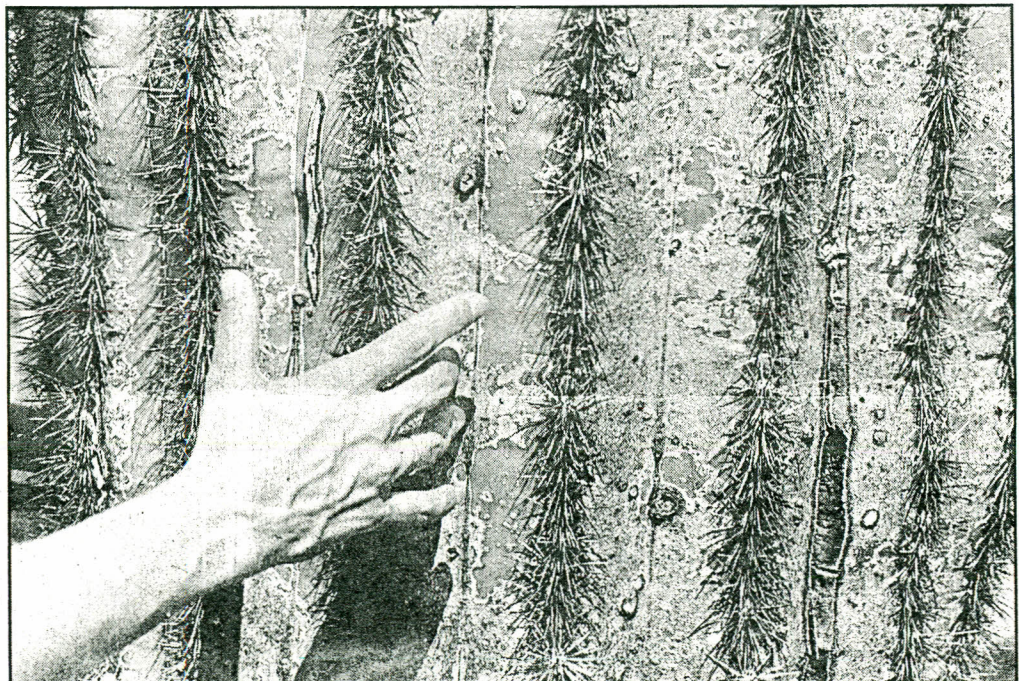
"We want to be able to say what is natural and what is not, and I very strongly suspect that the browning is part of the natural aging process and not connected to the decline" in the Rincons, Lajtha said.

"It is absolutely true that these saguaros are not doing well, and people have been worrying about the decline for quite some time," she said.

"But they are near the eastern limit of the saguaro's range, and it may well be that the decline in the Rincons is just part of the natural ebb and flow of a population on the marginal edge," Lajtha said.



Photos by A.E. Aralza, The Arizona Daily Star
Boston University biologist Kate Lajtha uses infrared thermometer to check saguaro



"Epidermal browning," seen on the southern side of mature saguaro.