

## Ozone lack suspected in saguaro kill

By Jim Erickson  
The Arizona Daily Star

Winter freezes, capricious monsoons, livestock grazing, car exhaust, declining bat populations, wood-cutting, air pollution — yes, even thirsty pack rats.

All have been advanced as possible explanations for the mysterious disappearance of the giant saguaro forest in Saguaro National Monument's Rincon unit, east of Tucson.

Add ozone depletion to the list.

A New York researcher has suggested 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.

### Ultraviolet rays suspected

Lance Evans, a biology professor at Manhattan College, suspects increased levels of ultraviolet radiation trigger a buildup of the saguaro's waxy outer cuticle layer.

The waxes accumulate until they seal off the exterior of the plant, blocking respiration and suffocating the cactus.

"The waxes on the surface build up and build up and close off the surface so there's very little gas exchange," said Evans, who has been studying Southern Arizona's saguaros for 2½ years.

"Years after the waxy layer starts building up, the saguaro rots because it's all sealed off," he said.

### Epidermal browning

Evidence for the rotting eventually is seen on the trunk of the saguaro as brown scabby patches called epidermal browning or "brown decline," according to the Evans hypothesis.

Epidermal browning usually begins on the south side of adult saguaros, four or five feet above the ground, then gradually spreads. The link between southern exposure and epidermal browning suggests the sun may play a role, Evans said.

"I think it's definitely sun exposure, and UV (ultraviolet radiation) is a good possibility," Evans said.

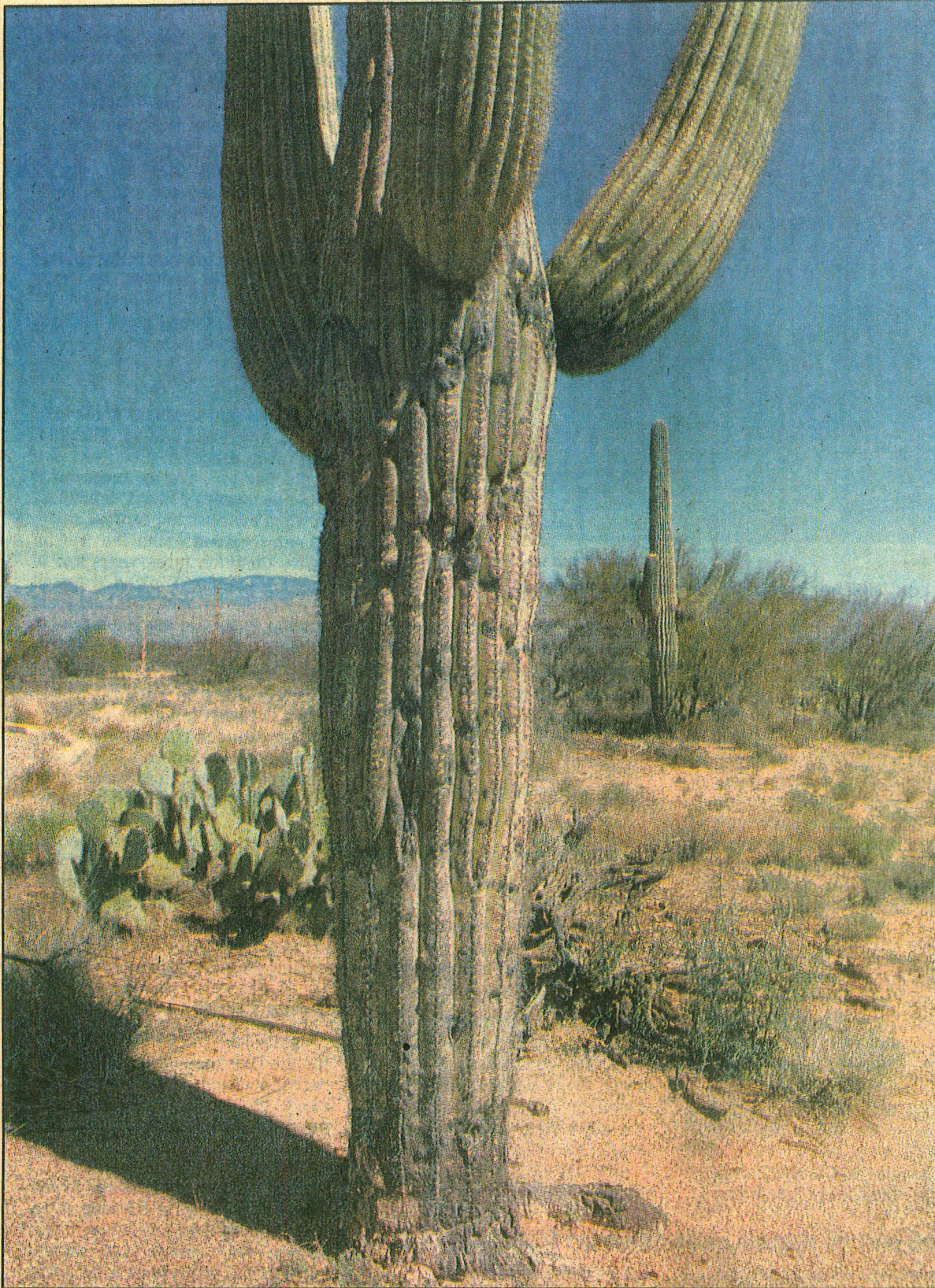
His research team has collected and analyzed tissue and cuticle samples from 472 saguaros so far. They've also studied archival photographs of monument saguaro forests taken since the 1930s.

### 30 reports presented

Early results were presented last month at a two-day conference on research in Saguaro National Monument. About 30 research reports were presented during the conference at the Hilton Hotel, 7600 E. Broadway.

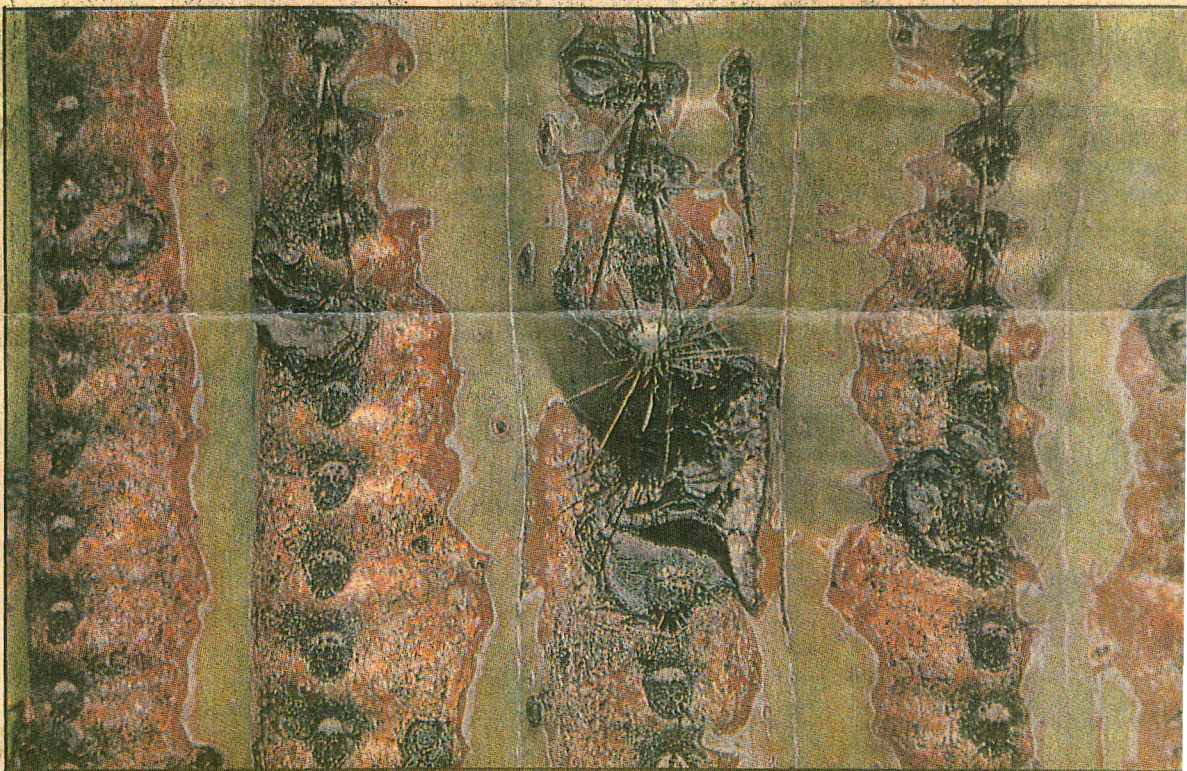
Saguaro National Monument was established in 1933, primarily to preserve the impressive stands of giant saguaro cacti. The two monument districts — the Rincon Mountains unit and the Tucson Mountains unit — are some 30

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1989 Star photo

Lance Evans says waxy buildup on saguaros prohibits any gas exchange, helping cause rot



1989 Star photo

Rotting such as this, called epidermal browning, one theory goes, may be due to the sun's rays

# Saguaros

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miles apart, separated by the city of Tucson.

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

Last week members of the Arizona congressional delegation introduced legislation to add 3,560 acres to the monument's Rincon unit.

## Bill has backing

Rep. Jim Kolbe, R-Ariz., and Rep. Morris K. Udall, D-Ariz., sponsored the bill in the House. Sen. John McCain, R-Ariz., sponsored it in the Senate.

Kolbe has said the expansion is important, in part, because studies have shown that the giant Rincon saguaros are disappearing.

That decline was first noted in the late 1930s, when researchers saw that the Rincon saguaros weren't producing enough seedlings to maintain a steady population.

It now appears there was a gap of some 60 years — from the turn of the century through the early 1960s — when very few saguaro seedlings survived in the Rincons, said Raymond Turner, a botanist who's been studying the giant cacti for 35 years.

In 1961, Turner and others set up test plots to monitor the health of saguaros in the two monument units and elsewhere in Southern Arizona and northern Mexico.

They found that many new seedlings were added to the Rincon saguaro population in the 1960s and 1970s, he said.

But when the Rincon monitoring plots were checked in 1989, about 80 percent of the saguaros that had been healthy in the early 1960s were dead.

Across the valley in the Tucson Mountains, only 26 percent of the test saguaros had died since the plots were set up.

## Forest depletion

What's left of the mature saguaro forest in the Rincon unit will be gone by the year 2000, some experts contend.

"There's something going on in Saguaro East that's certainly worthy of study," said Turner, who works for the U.S. Geological Survey in Tucson.

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

Livestock grazing, wood-cutting, disease, insufficient summer rain, and a decline in pollinators such as bats and birds all have been suggested.

The effects of air pollution — from copper smelters, acid rain,

auto emissions, pesticides, herbicides, or the lime kilns that once operated in the area — also are being studied.

One researcher believes pack rats may be partly to blame. When prickly pear and cholla aren't available, the rodents gnaw on saguaros to get moisture, according to that idea.

And now comes ozone depletion/ultraviolet radiation. The Evans model has a few obvious problems:

- Evans can't demonstrate that stratospheric ozone has been depleted over Southern Arizona since the Rincon saguaros started to decline, apparently around the turn of the century.

## Can't show increase

- He can't show an increase in ultraviolet radiation here since the decline began.

- He can't explain how increased ultraviolet radiation triggers the buildup of wax.

- If ultraviolet radiation is the problem, why haven't all saguaros — in forests across the entire range of the species — been decimated like the Rincon plants?

In response to the last point, Evans says epidermal browning is found on adult saguaros throughout the range of the species.

Maybe epidermal browning is weakening all saguaro populations, making the plants susceptible to attack by other forces, he said.

## Some stands worse

Individual saguaro stands such as the Rincon cacti may be worse off because local stresses, such as overgrazing, are added to the stress of epidermal browning.

In response to charges of scarce data, Evans says he's working on it.

He plans to test the proposed link between epidermal browning and ultraviolet radiation by shielding some saguaros with UV filters.

He pointed out that temperature, rather than ultraviolet radiation, could explain the correlation between southern exposure and epidermal browning.

Turner believes that a new generation of saguaros has gained a foothold in the Rincon Mountains and will someday rise up to replace the dying giants.

He says there's nothing wrong with the species as a whole, though individual populations rise and fall fitfully.

But if Evans is right, maybe all saguaros are in trouble. Maybe the Rincon saguaros were just the first to go because other stresses hastened their demise.

"I think some day they'll have a pretty good idea what's going on out there — maybe in another 50 years," Turner said.