

THE SAGUARA

Edward N. Munns, BU487

[Ed. Note: This is another in our series of reprints of articles from previous editions of the *Unit journal*. It was originally published in the October-November 1966 edition of *Bio-Philately* (Vol. 16, No. 2, p. 85). This article appeared before we had the capability to include illustrations. So, I have tried to enhance it with appropriate images. I have also updated the scientific name to the current one accepted. Throughout this article, the author used "saguara," an out-of-date common name for the saguaro cactus.]

[The saguaro cactus is thriving in the Sonoran Desert in 2017. The announcement of its impending demise in this article was greatly exaggerated and the cause of the loss of some plants was mistakenly attributed to a "disease." See the epilogue following the article for a discussion of the scientific study regarding this situation. It provides a cautionary tale that one should apply continual skepticism when dealing with scientific "facts," especially those that pertain to biological studies.]

[Edward Norfolk Munns (1889–1972) was Head of the U.S. Forest Service's Division of Silvics. He was the author of several books and reports on forestry and forest management. He was also instrumental in proposing and getting approval for the John Muir commemorative stamp (Sc#1245).]

The Giant Cactus (*Carnegiea gigantea*) or Saguaro of Arizona is doomed. By the end of this century, probably only a few plants will remain alive as most are now afflicted with a virus, the cactus cancer. Spread by a moth, this virus is now taking about four percent of the living plants a year, with up to 90 percent of all plants in some areas being affected.

A few survive an attack, but this may be only a temporary condition, not immunity. When the saguaro goes, some of the desert birds and animals that depend on it for food, water, or protection may also vanish. We shall know in another ten or 20 years. Even the Papago Indians will be adversely affected. And all of us will lose the cactus candy.



Carnegiea gigantea
USA, 1953, Sc#1028



Ulmus americana
USA, 1953, Sc#1023

The flower of the Giant Cactus is the state flower of Arizona. It is shown on a four cent stamp issued in 1962, commemorating Arizona's 50th birthday. The stamp also shows a mature plant. Another is depicted on the four cent Gadsden Purchase stamp of 1953.



Carnegiea gigantea
USA, 1962, Sc#1192

America has witnessed similar catastrophes as even species of trees have been all but exterminated as have various species of wildlife. The American Chestnut (*Castanea dentata*) has been killed out by the chestnut blight. The American Elm (*Ulmus americana*) is going fast because of the Dutch Elm disease, and the Bigcone Spruce (*Pseudotsuga macrocarpa*) is threatened by fire.

America has lost the Passenger Pigeon (*Ectopistes migratorius*) and the Heath Hen (*Tympanuchus cupido cupido*) and is in danger of losing the Whooping Crane (*Grus americana*). A Texas Prairie Chicken (*T. cupido attwateri*) may be next and we came close to losing the Wild Turkey (*Meleagris gallopavo*).

The Saguaro grows very slowly, less than an inch per year in height. At 100 years, it may be all of 16 feet tall. It attains a maximum height of about 50 feet when perhaps 200 years old. Blossoms first appear when it is about 30 years old, but in profusion only when about 50. At about 75 years, it begins to form arms

that make such sweeping curves that plant becomes most attractive.

The cactus is a water hog. During any rains, the roots soak up all the water possible. In a single rain storm, the plant may take up 2000–3000 pounds of water that is transpired slowly over the rest of a year.

The spongy inner tissue surrounded by accordion-like pleats, gradually expands with water. This living storage tank is fed by a profusion of thick roots reaching out perhaps 100 feet. During the dry season, the plant shrinks as it loses its water. The normal annual rainfall of the regions in which the cactus grows is from three to ten inches.

Epilogue

As Paul Harvey famously said, “And now the *rest* of the story.” This information is taken from the following study: “Saguaro Disease Investigations” from *Case Study of Research, Monitoring, and Management Programs Associated with the Saguaro Cactus (Carnegiea gigantea) at Saguaro National Monument, Arizona*. Joseph R. McAuliffe. Tucson: University of Arizona. 1993, pp.11–16.

“[I]n 1939 and 1940, [University of Arizona] plant pathologist James G. Brown reported the existence of an unidentified bacterial disease that was afflicting the saguaros of the saguaro forest and other parts of southern Arizona. Survey plots within SAGU [Saguaro National Monument] examined by Brown indicated that up to 20 percent of the giant cactus plants were infected. The supposed causative agent [was] a bacterium (*Erwinia carnegieana*).... The earliest reports, both in the scientific and popular press fueled a hysteria that the saguaro stands of the Sonoran Desert, especially the saguaro forest of SAGU could potentially succumb to the ravages of this disease.

“From the earliest reports, the blackening necrosis that was ravaging the saguaro population at SAGU was referred to as a pathogenic disease. This disease hypothesis, in an era of chestnut blight, Dutch elm disease, and white pine blister rust, was uncritically accepted, and personnel of the US Department of Agriculture (USDA) Bureau of Plant Industry (BPI) began immediately with “disease suppression experiments” in SAGU. The principal goal of the experiment was to determine if spread of the disease could be checked by removing affected plants that were the possible source of inoculation of healthy plants. This was a war-like stand against yet another catastrophic ‘enemy.’”

The USDA selected an entire section of land, on half of which they removed all “diseased” plants, which were then disinfected and buried. They compared the treated half with the adjacent untreated half in which no disease-control measures were taken.

“Subsequent monitoring of this experiment showed no marked differences between the treated and untreated areas in the development of further cases of the “disease.” Investigators from BPI reported this finding but, nevertheless, claimed that the experiments may have held the disease in check to some extent. The repeated assertion of the possible benefit of these experiments without data to back up such statements demonstrates the mind-set of uncritical acceptance of the disease hypotheses under which the plant pathologists were working.”

Some biologists questioned this hypothesis, but research on the bacterial necrosis “disease” continued for at least 20 years. A moth whose larva tunnels in live cactus tissue was identified as the principal vector of the disease. In 1962, biologists extrapolated the losses from the “disease” into the future and predicted extinction of the saguaro forest as Munn mentions in his article.

Despite all this, the hypothesis that a disease was the cause of the saguaro mortality was eventually rejected. The University of Arizona ecologist Charles H. Lowe concluded that catastrophic freezes cause considerable mortality in saguaros at the northern and eastern margins of their range and that the subsequent, but sometimes delayed bacterial decomposition of freeze-killed tissues was mistakenly diagnosed as a “disease.”

In 1911, Forrest Shreve, the pioneer of Sonoran Desert plant ecology, published a short paper titled “The influence of low temperatures on the distribution of the giant cactus.” He argued that the greatest number of consecutive hours of sub-freezing temperatures was the most important factor controlling the northward and upper elevation distributional limits of the saguaro.

Shreve’s experiments went unnoticed for nearly a half century until Lowe explained the catastrophic loss of cacti as a consequence of periodic, prolonged freezing events. The bacterial necrosis first observed in 1939 was the direct consequence of the 1937 freeze event during which temperatures dropped lower than they had for more than 20 years. Lowe and others:

“concluded that the ‘saguaro necrosis disease’ was an extremely mistaken interpretation. Instead, this condition was neither a disease nor cause of death, but rather the consequence of mortality due to freeze damage followed by natural (and often delayed) bacterial decay of moribund plants.”

Lowe’s findings provided better management practices for the National Park Service. The author of this study observes that this more ecological perspective might have been achieved far sooner had those involved with the saguaro “disease” investigations been aware of the seminal work of Shreve.