

INSECT AND DISEASE CONDITIONS
MAMMOTH CAVE NATIONAL PARK, KENTUCKY

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By

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ABSTRACT

An aerial and ground survey was conducted May 26 and 27 on the 51,000 acre Mammoth Cave National Park. Insect and diseases observed included pine sawflies, annosus root rot, Dutch elm disease and persimmon wilt. This is the first known occurrence of Dutch elm disease on the Park.

INTRODUCTION

Aerial and ground surveys for the detection of insect and disease conditions were made on the Mammoth Cave National Park on May 26 and 27, 1969 by C.E. Cordell and T.H. Flavell, Division of Forest Pest Control. John Rogers, Park Ranger, assisted in both phases of the survey.

The Mammoth Cave National Park occupies approximately 51,000 acres of characteristic Karst topography in west central Kentucky. The forest cover is composed predominately of oak-hickory-pine type with eastern red cedar the dominant pioneer species on the numerous old fields within the Park boundary.

Reportedly discovered by a bear hunter tracking a wounded bear in 1799, the cave was set aside in 1938 as the Mammoth Cave National Park for the enjoyment and education of the public. Since that time the recreational facilities have been constantly improved and presently include a modern motor hotel, dining room and gift shop. More than one million visitors, many of them school children, are expected to visit the cave this year.

SURVEY METHODS

A one hundred percent aerial sketch map survey was made of the 51,000 acres within the Park's boundary on May 26, 1969. A Cessna 182 aircraft flying approximately 1,000 feet above the terrain at an airspeed of 100 mph was used to fly east-west flight lines spaced one mile apart. Observers seated on opposite sides of the aircraft plotted all trees showing symptoms of insect or disease attack within a one-half mile strip on either side of the flight lines. (Fig. 1)

The area was ground checked immediately upon completion of the aerial survey. Samples were collected from suspected diseased trees for culturing in the laboratory.

RESULTS

INSECT CONDITIONS - A complex of pine sawflies, represented primarily by the Virginia pine sawfly, *Neodiprion pratti pratti* Dyar was found in association with scattered heavy defoliations of shortleaf pine, *Pinus echinata* Mill., and Virginia pine, *P. virginiana* Mill., on the Park (Fig. 2-a). However, at the time of this survey most of the sawfly larvae had pupated.

DISEASE CONDITIONS - Three elms were found infected with Dutch elm disease, *Ceratocystis ulmi* (Buism.) C. Moreau, two on the rear lawn of the Park headquarters and Visitor Center and one in the Hotel parking area. Two infected American elms, *Ulmus americana* L. were dead ; the adjacent winged elm, *U. alata* Michx. was living (Fig. 2-b). Typical *C. ulmi* graphium spore stages were obtained in the laboratory cultures. The smaller European bark beetle, *Scolytus multistriatus* Marsh. was found beneath the bark of one of the dead American elms.

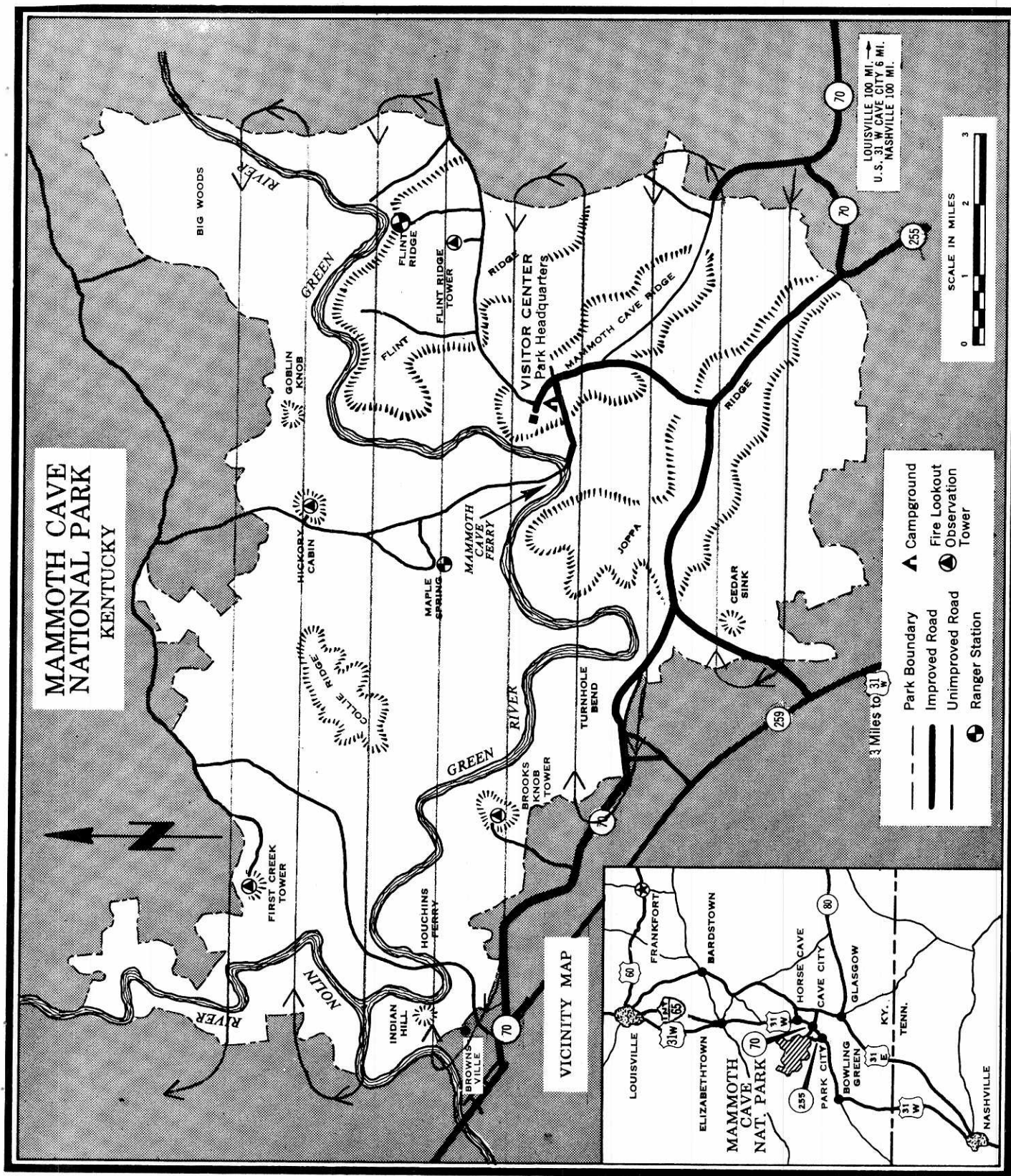


Fig. 1 Aerial Survey of May 26, 1969

The annosus root rot, *Fomes annosus* (Fr.) Cke. infection center on the southwest boundary of the Park near Silent Grove was re-examined. Twenty-five dead standing shortleaf pines, *P. echinata* Mill. were found (Fig. 2-c). *F. annosus* fruiting bodies were found at the base of several dead trees (Fig. 2-d).

In addition, the persimmon wilt fungus, *Cephalosporium diospyri* Crandall was cultured from samples taken from a dying persimmon *Diospyros virginiana* L. located behind the Ranger residences.

DISCUSSION

There was very little indication of insect or disease problems observed from the aerial survey. Several hardwood suspects were plotted on the maps for ground checking. Ground observations revealed a general occurrence of oak dieback - decline symptoms. This condition is currently widespread throughout the oak type in the eastern U.S. The problem has been attributed to a combination of physiological, climatic and biological factors (Staley, 1965 ; Nichols, 1968).

Although the defoliation of shortleaf pine and Virginia pine by the Virginia pine sawfly was heavy in some areas it is not felt to represent a serious threat to the pine at this time. This pine sawfly which is an early Spring defoliator consumes only the old foliage leaving the current year's foliage to provide for the tree's photosynthetic needs. Under certain conditions, e.g. repeated defoliation of over-mature trees under moisture stress, this defoliator can cause mortality. In light of this, it is worthwhile to keep a reasonably close check on the moisture conditions under which the defoliated trees are growing.

Dutch elm disease has been present in the U.S. for nearly 40 years. The disease was first found in Cleveland, Ohio in 1930 and was apparently introduced from Europe on elm burl logs. Since then, the disease has been found in the majority of the eastern and central States. All native elms are susceptible to the disease. The primary means of *C. ulmi* spread is by elm bark beetles - the small European elm-bark beetle (*S. multistriatus* Marsh.) and the native elm-bark beetle (*Hylurgopinus rufipes* Eichh.). The principal carrier of the fungus in the U.S. is the smaller European elm-bark beetle. Local spread frequently occurs through root grafts.



Fig. 2-a Virginia pine sawfly defoliation on Virginia pine. (Note new shoot growth)

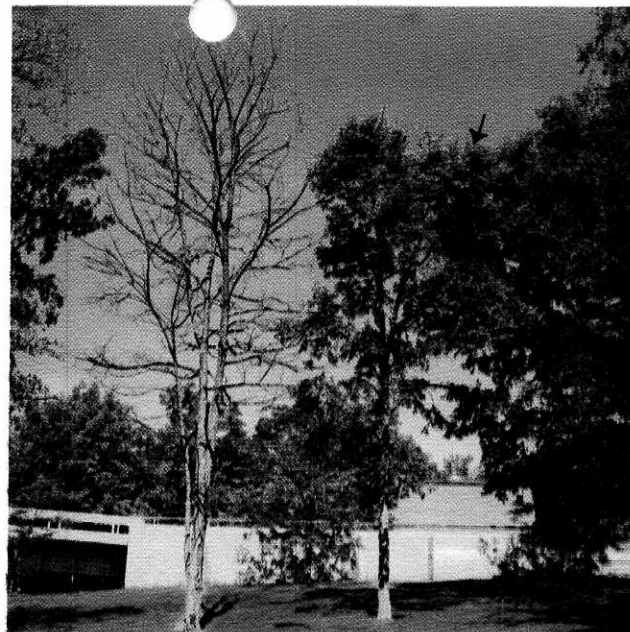


Fig. 2-b Dutch elm disease - one dead American elm and one infected living elm with visible symptoms only in terminal (arrow).



Fig. 2-c Annosus root rot infection center in natural shortleaf pine stand.



Fig. 2-d Fomes annosus fruiting body (conk) at base of dead shortleaf pine.

Fig. 2 Insect and diseases found during an aerial and ground survey of Mammoth Cave National Park, Kentucky, May 26 - 27, 1969.

This is apparently the first known occurrence of Dutch elm disease on the Park. However, the disease has been known to occur in Kentucky for over ten years and has been found in nearby Barren County. The disease represents an immediate and serious threat to the numerous elms in the Park Headquarters and Visitor Center area. Every effort should be made to protect these valuable shade trees.

Shortleaf pine mortality in the *F. annosus* infection center increased significantly during the past year. Only one dying tree was observed in June, 1968 (Rauschenberger and Knighten, 1968). The center had twelve dead trees when first detected by John Rogers, Park Ranger, in 1966 (Rauschenberger, *et. al.*, 1966). There was no visible evidence of previous cutting (old stumps) in the stand. However, the fungus probably entered the stand either through exposed stump tops that have since deteriorated or through wounds inflicted to roadside trees during road building operations on Highway 70. This disease also poses a serious threat to the remaining trees in the natural shortleaf pine stand.

This is also apparently the first known occurrence of persimmon wilt on the Park. This disease has also been present in the eastern U.S. for several years. However, the erratic distribution of the disease as well as its host usually renders it insignificant.

RECOMMENDATIONS

1. There is no direct control method available for Dutch elm disease. The two most effective types of control for the disease are sanitation of dead and/or diseased elm wood and chemical spraying of living elms. Both methods are preventive treatments and must be properly applied at the right time to be effective.

Sanitation involves the destruction of all dead and diseased elm wood in the area to be protected. This action eliminates breeding places for the elm bark beetles and helps to reduce their populations. Therefore, all three elms, the two dead and the living infected, should be cut and burned immediately. In no case, should any of the cut wood be left in the area for any period of time.

The stumps should be treated with Ammate crystals. Also, frill the primary lateral roots at the root collar and apply ammate crystals. Apply the ammate as a liberal coverage to the stump surface and the frills. The ammate should kill the stump and, thereby, prevent local spread of the disease through root grafts.

2. A dormant preventive spray should be applied to elms in the immediate area early next Spring prior to bud break. Methoxychlor has replaced DDT for this treatment as a result of the toxic and residual characteristics of the latter insecticide. The insecticide should be applied liberally to all bark surfaces (stems, branches and twigs) with a high pressure hydraulic sprayer at a dosage rate of 16 pounds technical grade per 100 gallons of water. The preventive spray is aimed at killing the beetles that feed in twig and leaf crotches and , thereby, prevent transmission of the fungus to healthy elms.
3. There is no direct control method that has proven to be effective once *F. annosus* gains entrance into a pine stand. However, several methods have been promising under experimental conditions. One of the most promising has been a biological control treatment using the harmless fungus saprophyte *Peniophora gigantea* (Thore) Loyd as the biological agent. The size and arrangement of the *F. annosus* center in the shortleaf stand on the Park makes it very desirable for a field test of the effectiveness of *P. gigantea* in controlling *F. annosus* in an established infection center.

With the Park's concurrence, the Division of Forest Pest Control, would like to install such a test. Forest Pest Control would provide the technical assistance and materials for treatment. The treatment should be applied in the Fall (September or October) 1969. A two-man crew would be needed from the Park for one day.

4. The only action that could be taken in regard to the persimmon wilt would be to cut and destroy the row of affected trees (intermingled with sassafras) behind the Ranger residences and poison the stumps with ammate similar to the Dutch elm disease treatment. However, there is no need to spray adjacent trees.

5. At this time, applied control of the sawfly population is not recommended. Unless severe defoliation occurs again next Spring in conjunction with drought conditions the effect of the defoliation is expected to be negligible.

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