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1987

Research Synopsis of Patterns of Community Dynamics in the Sunken Forest 1967 through 1986.

1. Research methods used were identical to those used by H.W. Art in his dissertation thesis in 1971 and in the 1976 Scientific Monograph, Sunken Forest, Fire Island, New York by Art. Nineteen of the original plots surveyed in 1967 were relocated in 1985 and then resurveyed again in 1986. In addition, the ecosystem study plot first surveyed in 1968 was resurveyed in 1985 and 1986.

TREES

- ✓ 1. The nineteen permanent plots showed relatively little change in the density of trees although the numbers of *Ilex* showed a small decline from 7.2 to 6.8 stems per 100 square meters while *Amelanchier* and *Sassafras* were relatively constant.
2. In the ecosystem study plot there was a decrease in density from 20 stems per 100 square meters to 15. All major ✓ tree species showed declines, and *Nyssa* had the greatest relative decline.
3. Basal Area. From 1967 through the mid-1980's there was an overall increase in basal area from 2,360 sq. cm. per 100 square meters to 2,660 sq. cm. per 100 square meters and in 1986 to 2,790 sq. cm. per 100 square meters. *Ilex*, *Sassafras* and *Amelanchier* all increased slightly from 1967 through 1985, and *Amelanchier* may have shown a slight decrease in basal area from 1985 to 1986 as an influence of Hurricane Gloria.
- 7 4. Ecosystem study plot had an increase in basal area from 3400 sq. cm. per 100 square meters to 3772 sq. cm. per 100 square meters followed by a slight decrease in 1986 through the influence of Hurricane Gloria. The ecosystem study plot seemed to be hit by hurricane more intensely than many other areas within the Sunken Forest. This can be seen by the increase in tree height in the ecosystem study plot from 5.7 meters in 1967 to 6.5 meters in 1985, and then a decline to 5.9 meters in 1986. When the individual tree canopies in the ecosystem study plot were assessed for percent canopy damage attributable to the hurricane was expressed on a percent of the basal area impacted and density impacted, it appears that 30 per cent of the canopy in the ecosystem study plot were killed or damaged by Hurricane Gloria and 25 per cent of the density. This would indicate the larger trees with larger canopies are influenced more directly than smaller trees that are in a more sheltered position.

5. The standing dead trees in 1985 and 1986 are mostly Sassafras, which make up greater than 30 per cent of the density and more than 50 per cent of the basal area of standing trees while Amelanchier made up 50 per cent of the density and basal area and Vaccinium comprised 15 per cent of the density and 5 per cent of basal area of the standing dead trees.

Diameter Distributions.

The diameter distributions of Ilex, Sassafras, and Amelanchier were analyzed using 5 cm moving averages for the population of trees in the 1900 meter square plots. Ilex showed distinct changes in the diameter distribution between 1967 and 1985. In 1967 the peak diameter was between 9 and 11 cm and by the mid-1980's there was a shift to the right toward 13 to 17 cm d.b.h. This indicates that there are more larger trees and probably this species is increasing in biomass. As can be seen in the figure showing the difference between 1985 and 1986 diameter distributions, little hurricane effects can be seen in wholesale uprooting of this species although the canopies of some of the trees may have been damaged.

Sassafras has smaller populations than does Ilex. The peak and diameter distribution comes in the range of 13 to 19 cm with a slight suggestion of a shift to the right between 1967 and the mid-1980's. As with Ilex very little can be seen in the way of large scale hurricane effects on the diameter distributions of this species.

Amelanchier shows a remarkable consistency from 1967 to 1985 to 1986. All three of these years have diameter distributions showing a very similar reverse J-shaped curve probably indicating long term population stability for the species.

SHRUBS

1. The shrub layer in the Sunken Forest has undergone massive changes from 1967 through the mid-1980's. There has been a large decline in density of shrubs. In the mid-1980's the levels are at about 15 per cent of those in 1967. There has been only a slight increase in shrub density in the Sunken Forest 100 square meter plots following Hurricane Gloria, although there was a significant increase in shrub density in the ecosystem study plot in 1986.

2. Ilex glabra showed the greatest change in density between 1967 and 1985. Thirty per cent of the shrub density in 1967 was this species while only between 5 and one per cent of shrub density is Ilex glabra in the mid-80's. Pyrus also showed major reductions in density over the period. Ilex opaca was not very abundant at any time during the study.

can this be directly related to deer?

other influences besides deer?

*2000
1985*

A. Nelson

Other major tree species such as Sassafras and Amelanchier are relatively constant, although Sassafras may be increasing slightly after Hurricane Gloria.

3. Basal Area. There has been a decrease in shrub basal area from 1967 levels to the mid-1980 levels which are only 40 per cent of those of the earlier date. However, there has been some increase in shrub basal area following Hurricane Gloria, perhaps because of increased light incident on the shrub layer.

4. Height. In 1967 the average height of shrub layer was 1.75 meters. In 1985 the shrub layer had increased to 2.41 meters, but declined following Hurricane Gloria. This pattern has shown in both the 19 100-meter square plots and the ecosystem study plot.

5. Deer at browsing appears to be having a major impact on the shrubs especially Ilex glabra and Pyrus which I would suspect are favorite browse species by the deer. I would expect that we would see an increase in those species in the enclosures constructed in the summer of 1986.

HERBS

1. The herbaceous layer has shown the greatest changes between 1967 and 1985-86. Prior to the increase in deer populations in the late 70's, the herbaceous cover in the Sunken Forest as a whole was estimated to be at 34 per cent cover and in the ecosystem study plot it was 45 per cent cover. The cover in the Forest as a whole has declined to approximately 12 per cent cover, and in the ecosystem study plot it has declined to between one and six per cent cover. More strikingly than the decline in total cover is the reduction in herbaceous perennial species. Aralia nudicaulis has decreased from 8.8 per cent cover to less than one per cent cover. Similarly, Maianthemum has decreased from 1.7 per cent to less than .2 per cent. Smilacina stellata has decreased from 2 per cent to less than three one hundredths of one per cent. The 12 per cent cover in the Forest as a whole or 1 to 6 per cent cover of herbs in the ecosystem study plot is predominantly tree and shrub and liana seedlings. While there has been an increase in herb cover following Hurricane Gloria, this has been largely due to a four-fold increase in tree and liana seedling cover.

DENSITY

Density was not recorded in the 100 square meters Sunken Forest plots in 1967 although it was in 1985 and '86. From 1985 to '86 there has been a two-fold increase in Ilex, Sassafras, and Amelanchier seedlings. In the ecosystem study plot Ilex has shown a constant number of seedlings from 1968 through 1985, while Sassafras and Amelanchier increased

slightly during that period. Following the Hurricane Gloria there has been an increase in all tree seedlings except for Prunus serotina. The most striking post-hurricane effect has been a population explosion of Smilax rotundifolia seedlings. These are undoubtedly taking advantage of the opening up of the canopy above in the ecosystem study plot.

SUMMARY OBSERVATION

The tree layer in the Sunken Forest has changed little from the mid-1960's to mid-1980's. The effects of Hurricane Gloria in blowing over trees appear to be a very localized phenomena hitting areas of topographic exposure and impacting larger trees more than smaller trees. However, the canopy damage to exposed trees is quite evident, and it may take several years for these debilitating effects to be fully felt.

The major impact of deer on the Sunken Forest appear to be related to changes in the shrub and herbaceous layer with favored browse species such as Ilex glabra and Purus arbutifolia being the dominant woody species which have declined in abundance and cover from 1967 through the mid-1980's. Moreover, there has been a decimation of the perennial herbaceous component of the herb layer with many of these species finding refuge only under tangles of cat briar. The effects of hurricane on the herbaceous and shrub layer may eventually a stimulatior of growth and density of the strata. Data generated in the exclosures constructed in 1986 should help us to discern the future of the Forest herb, shrub and tree layers.