

Ecological Studies Of Sunken Forest

By Mary K. Foley

Maritime forests are unique communities that develop in secondary dune ridges where they are protected from salt-laden oceanic winds and waves. The Sunken Forest is a well-known maritime forest composed predominately of American holly (*Ilex opaca*), white sassafras (*Sassafras albidum*), and shadbush (*Amelanchier canadensis*) and the largest (16 hectares) of those is found on Fire Island, NY, within Fire Island National Seashore.

The Sunken Forest owes its continued existence to a combination of autogenic and allogenic factors affecting the development of the Forest over the past several hundred years. Severe storms causing overwash, inlet migration, sand deposition and erosion, salt injury, fire and animal-browse – all are examples of disturbances that affect maritime forest development and are believed to be vital to the long-term maintenance of the Sunken Forest (Art, 1976; Backman and Patterson, 1986; Art, 1987).

In recent years the Sunken Forest has become a popular site for park visitors with interpretive walks conducted several times a day during the summer season. Visitors walk through the Forest on raised, wooden boardwalks to protect the area. However, the numbers of visitors leaving the boardwalks to explore the darkened forest and to climb the secondary dune structures has increased. This, combined with an over population of deer, has raised a concern that natural regeneration and, hence, the long-term reproduction of the holly-sassafras-shadbush community may be restricted leading to a gradual increase in catbrier (*Smilax* sp.), poison ivy (*Rhus radicans*) and other invasives.

A thorough understanding of the importance of these factors to the continued development of the Forest is essential to insure that the natural processes which maintain it are not inadvertently altered. As it is believed that long term maintenance of the Forest depends on the occurrence of disturbances, the NPS initiated an investigation into the reproductive patterns of the Sunken Forest and an assessment of the impacts of disturbances such as deer, hurricane Gloria, rising sea levels, fire, and visitors.

In 1967, as part of his Ph.D. dissertation research, Dr. Henry Art analyzed vegetation through the establishment of 34 permanent vegetation plots in the Sunken Forest to determine the influence of meteorological nutrient inputs on the structure and function of maritime forest ecosystems (see NPS Management Series, No. 7, 1976). In 1985 and 1986 Art returned to the Forest to resample these plots to determine the pattern of succession since 1967 and to investigate the possible causes of change over the past 20 years.



Hurricane Gloria packed a measurable wallop when she plowed into the Fire Island NS's Sunken Forest on Sept. 27, 1985. (Photo by James Northrup, Grand Tetons NP).

Art was able to relocate 19 of the original 34 plots, observing after this first resampling that, although the deer population in the Forest has increased dramatically since 1967 from very low numbers to approximately 200 to 400 individuals by the mid 1980s, this increase has had little effect on the dominant species of the tree layer. However, Art believes that deer may be a major cause of the reduction of subordinate tree layer species such as *Ilex glabra*, *Vaccinium corymbosum* and *Gaylussacia baccata* in the shrub layer and herbaceous perennials such as *Aralia nudicaulis* and *Smilacina stellata*. Deer exclosures have been constructed around several of the permanent plots to verify that the reduction in these species is related to deer and not simply a successional response.

Another influence is related to changing ground water conditions. One plot was lost and another partially lost due to encroaching brackish water causing a transition from forest to marsh on the bayside of the island. Three other plots have dying trees attributable to encroaching salt water.

Also, on Sept. 27, 1985, hurricane Gloria (rated between a class 1 and class 2 hurricane on the Saffir-Simpson Hurricane Damage Potential Scale) passed over Fire Island with winds of 70-90 mph and gusts in excess of 90 mph, presenting a rare opportunity to evaluate the impact of severe storms on northern maritime forest dynamics. Although Gloria was responsible for uprooting many trees in the Forest, Art reports that the storm was far from devastating. Increases in overall basal area and density compen-

sated for the initial storm-induced mortality. The storm also appears to have stimulated growth in the shrub layer and recruitment of woody seedlings in the herbaceous layer.

These studies will continue in the Sunken Forest to quantify ecosystem effects and to examine other forest disturbances. For example, pollen and charcoal analyses by Backman and Patterson (1984) from bog samples from the Forest suggest that fire may be an important disturbance factor. Next spring two plots will undergo prescribed burns to develop more data on the response of this forest community to fire. Also, additional plots will be established in high visitor use areas. We hope to gather enough information about the dynamics of the forest to guide managers in the protection of this unique community type.

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References

- Art, Henry W., 1976. *Ecological Studies of the Sunken Forest, Fire Island National Seashore, New York. National Park Service Monograph #7, 237p.*
- Art, Henry W., 1987. *Patterns of Community Dynamics in the Sunken Forest: 1967 to 1985 and 1985 to 1986. NPS/OSS Technical Report, June 1987.*
- Backman, Andrew E. and William A. Patterson, III, 1986. *Fire and the long-term development of the Sunken Forest at Fire Island, New York, in: Fire Regimes of Fire Island National Seashore, NPS/OSS Technical Report.*