

Cumberland Island Fire Effects Study

By Kathryn Davison

Over the last three decades the natural role of fire has become increasingly important in the national parks. Studies of vegetation and wildlife responses to fire have guided fire policies away from total suppression towards natural fire research and management. Activity has centered in large western parks, however, and the effects of fire on many types of park ecosystems remain unstudied.

The need for more information is especially urgent in the Southeastern National Seashores, located on sandy barrier islands where the annual rainfall is sufficient for the growth of dense vegetation, but the summer is usually dry, punctuated by violent thunderstorms. The abundance of dry fuel and high lightning frequency have made fire a significant part of the evolution and ecology of the coastal vegetation. A large body of literature exists concerning the various plant communities of the mainland Coastal Plain, but little research has dealt with fire management of barrier islands or national seashores. Since barrier islands have some unique plant communities and have vegetation patterns unlike those of the mainland, establishing adequate management for National Seashores requires further analysis of their fire ecology.

The South-Cut Fire, which occurred in July of 1981 on Cumberland Island National Seashore, provided an excellent opportunity to document plant survivorship and regrowth after a natural fire on a barrier island. There had not been a fire on this part of the island for at least 15 years so that fuel loadings were high; 1981 was the last of four dry years, which had reduced considerably the water level of the freshwater marshes. The lightning-ignited fire swept over 1,700 acres, but was largely restricted to four community types: oak scrub, pine scrub, mature pine, and freshwater marsh. Major boundaries of the fire formed along the edges of mature hardwood forests where penetration was limited to the shrub understory and litter (Fig. 1 and 2). Biologists from the NPS Cooperative unit at the University of Georgia presently are comparing these five communities and their responses to this major burn in order more fully to understand the role of fire in the ecology of Cumberland Island.

Burn Study Begun

The Georgia Co-op began a study of the burn in December of 1981. Plots for tree data were laid out in the five major community types. Three levels of fire exposure were studied by maximum scorch height: ground (0-0.5m), shrub (0.5-3m) and crown (+3m). Herb, woody sprout and seedling regrowth were measured by percent cover and stem counts in transects along one side of the plots. The sites were revisited in the spring, summer and autumn for herb and shrub regrowth measurements. Comparison plots in unburned communities were sampled where possible. A large percent of the oak scrub on the island has burned in the last five years and all of the pine scrub burned in the 1981 fire, thus for pond pine communities unburned comparison sites are not available on the island. The results of the study have

not yet been analyzed, but some general observations have been made. The following is a description of each of the major community types and some notes about their responses to the fire.

The mature hardwood forest is of particular interest because it was here that the fire stopped. This forest has a closed canopy of 20-25 meters inside of which a more humid microenvironment is enclosed. Litter dries out less rapidly here than in the more open oak scrub forest. Live oak, *Quercus virginiana* is the most common tree of both the mature hardwood and the more fire prone oak scrub forests. Other canopy species of the mature forest include: sweet bay, *Magnolia virginiana*, red bay, *Persia borbonica*, cabbage palm, *Sabal palmetto*, black gum, *Nyssa sylvatica*, holly, *Ilex opaca*, and red maple, *Acer rubrum*. The shrubby understory is often dominated by saw palmetto, *Serenoa repens* which can form a continuous layer under the oaks. Small trees of live oak, red bay, wax myrtle, *Myrica cerifera*, sparkleberry, *Vaccinium arboreum*, and staggerbush, *Lyonia ferruginea* are scattered in a distinct understory. There is little herb cover excepting isolated patches of bracken fern and panic grass.

Overstory Trees Survived

The overstory trees, with the exception of maple and holly have thick bark and survived the fire very well. Where the fire entered the forest it was carried mainly by the saw palmetto through the understory, and most of the smaller trees were killed. However, all of the species that lost individuals to the fire are represented in the regrowth. Seedlings of maple, holly, wax myrtle and red bay have been found in areas where the species had existed previously. The strongest form of regrowth in terms of numbers and percent cover has been root and rhizome sprouting. Saw palmetto survived the fire very well. Most of the leaves were consumed, but the large rhizomes were well insulated and quickly replaced the lost foliage. Live oak, red bay, staggerbush, and wax myrtle have gained much height and ground cover over the last year through root sprouts. No new tree species have appeared and as yet, none have been lost in the areas studied. There is some change in the age distribution of individuals for this community, but little to no change in species composition.

The oak scrub is a forest type which grows in relatively sterile, well drained sands in upland sites. The canopy is open and low, 10-15 meters. Three oaks form the majority of the canopy with live oak being the most common, followed by myrtle oak, *Q. myrtifolia*, and Chapman's oak, *Q. chapmanii*. Other canopy species include: American olive, *Osmanthus americana*, red bay, staggerbush, and scattered slash and pond pines. A less distinct understory than in the mature hardwood forest consists of a dense growth of staggerbush, sparkleberry, saw palmetto, gallberry *Ilex glabra* and dwarf *Vaccinium myrsinites* blueberry; the open nature of the canopy allows the litter to dry rapidly, and the less distinct boundaries between the overstory and the understory present a relatively con-

tinuous vertical arrangement of fuel. Fire can be carried easily into the canopy.

Possible Futures

The fact that most of the oak scrub on the island has burned within the last five years, and that this same area on the northern end burned about 25 years ago to approximately the same boundaries suggests that this community is a pyric disclimax, and is being maintained by fires of natural origin. In the absence of killing crown fires, the oaks may eventually form a closed canopy and the community could then succeed to a more mature forest. However, the sterile soils allow only slow growth of the trees. The time needed for trees to grow large enough to form a closed canopy is usually much longer than the time between fires, due to the climate and the accumulation of fuels.

The mature pine community is characterized by even-aged stands dominated by one of three pines: loblolly, *Pinus taeda*, slash, *P. elliotii* or longleaf, *P. palustris*. These may be mixed with live oaks. The canopy is high (22-28m) and partially open. Saw palmetto is common, but not dense. Much of the ground cover is grasses and other herbs.

The response to the fire in this community varied greatly with fire severity. Most of the areas experienced no crown fire. In this case, the larger pines survived and the community was little changed. However, in one area near the edge of the salt marsh high winds brought flames into the canopy of a stand of loblolly pines. All of the trees were killed. The regrowth in this area is primarily herbaceous. The saw palmetto is resprouting here as it has everywhere else it occurs. A few seedlings of pine, wax myrtle and winged sumac *Rhus copallina* have been found, but they are not abundant, as most of the ground is covered with fallen trees and lush herb growth.

Pond Pine Regrowth Variable

The pine scrub or pocosin community is a swampy forest where pond pine, *Pinus serotina*, is the most common tree. The understory is much the same as in the oak scrub but, with little to no oak component except on the drier sites. Pine scrub grades into swampy marsh on the wetter sites where marsh herbs are more common than the shrubs, and into oak scrub on the drier sites that have a very small amount of herb cover.

All the pond pine on the north end of the island was involved in the fire; the majority experienced severe crown fire. Those pines that did survive have sprouted epicormically* to replace needles lost to the blaze. The serotinous** cones held on the trees opened in the heat; and many seedlings have been found, especially on the wetter sites.

Regrowth of pond pine has been variable. Healthy root sprouts are growing in the drier sites among the sprouts of saw palmetto, gallberry, heaths and oaks. Pine seedlings in these areas have not survived well,

*Growing from a dormant bud exposed to light and air.

**Occurring in the latter, drier part of the summer.

being shaded out by the dense sprouts.

On the wetter sites, hardwoods and saw palmetto have not grown back as densely. Here, the root sprouts of pond pine died a few months after they came up, but many healthy seedlings were found. It should be noted that the root sprouts of staggerbush, *Lyonia lucida*, gallberry, blueberries, and especially saw palmetto flowered and fruited much

more heavily inside the burn than outside, and were attended by a host of pollinating insects. This was particularly apparent in the oak and pine scrubs.

Freshwater Marshes Bounce Back

During the last days of the fire, the northern end of the sweet-water marsh complex caught and burned southward to South-Cut Road which effectively

blocked its spread. *Spartina bakerii*, a hummocked cordgrass, is the most common species of these marshes, forming a nearly continuous band through the sweet-water complex. Due to the dry conditions the grasses carried a hot blaze over the marshes. The surrounding trees generally did not survive, and most of the above-ground vegetation in the marsh was killed. However, the grasses, shrubs and forbs all

FIGURE 1. PLANT COMMUNITY DISTRIBUTION ON THE NORTH END OF CUMBERLAND ISLAND NATIONAL SEASHORE.

(ADAPTED FROM HILLESTAD & BOSEMAN, 1974.)



LEGEND

■ FRESHWATER MARSHES

▣ MATURE HARDWOOD FOREST

◻ MIXED OAK AND MATURE PINE FOREST

● PINE SCRUB

▲ OAK SCRUB

--- ROADS AND TRAILS

Cumberland Island (Continued)

have grown back from the old root systems. The grazers (horse and deer) seem to prefer the burned over grasses to those in unburned areas. Grasses in identical marshes on either side of South-Cut Road are cropped down to six inches on the burned side and not significantly grazed on the unburned side. The freshwater marshes have replaced the biomass lost to the fire more rapidly than any other community in the study and in terms of percent cover may have benefited from the fire.

These preliminary observations indicate first that natural fire is an important ecological factor on Cumberland Island, and at least 15 percent of the upland vegetation of the island is subject to natural fire on a 15 to 30 year rotation. The island has some vegetation types, such as pine and oak scrub, that develop high fuel loadings. The marsh and scrub communities of the island generally are fire tolerant, however, while even a hot fire has difficulty burning into the more fire sensitive but less flammable live oak forest.

Fire is important to ecosystem structure and func-

tion on the island and requires a sophisticated management planning. In this case, some of the problems encountered in western parks where natural fire plays an important role, can be avoided by a resources management program which permits "management fire" and anticipates the development of high fuel loadings.

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FIGURE 2. BOUNDARY OF THE SOUTH-CUT FIRE ON CUMBERLAND ISLAND NATIONAL SEASHORE, 1981

