

Fire Management and Resource Management at Big Cypress National Preserve

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Big Cypress National Preserve is located in southwestern Florida, north and west of (adjacent to) Everglades National Park. Wetland communities, especially those dominated by bald cypress (*Taxodium distichum*) trees, make up much of the preserve's landscape. Topographic relief in the preserve is limited, with a gradual slope (about 1 foot per mile) toward the coast, so that most of the preserve is under at least few inches of water during the summer rainy season. The flat nature of the land also supports large areas of shortgrass prairies and sawgrass marshes. These graminoid communities naturally burn every few years, so that fire is a common and significant ecological factor.

Fire Management

The Big Cypress prescribed fire management program is the largest in the National Park Service (NPS) in terms of the amount of burning accomplished. The preserve burns about 40,000 acres annually to reduce accumulated fuels in plant communities. This program has about 20 full-time employees, and in 2002 made up about half of the area in the National Park System that was burned for fuel reduction. Property owners in areas that may be affected by nearby fires are contacted when they are available; prescribed fires are almost always well received by adjacent property owners, as fires historically were used to reduce fuels or improve forage for domestic or game animals. Preserve fire management staff work closely with the state of Florida's Division of Forestry, as state restrictions often constrain fire operations.

Resource Management

Resource management at Big Cypress actively shares information about the preserve's natural resources with other divisions in the preserve. This is a practical application of the science needed to understand natural systems. Communication with fire management staff is especially valuable, as fire is a common and important abiotic component of southern Florida's ecology.

Wildlife management. Management concerns for fauna in the preserve include fire's impact on species such as Florida panther (*Felis concolor coreyi*) and its prey animals that

reside in mesic-to-hydric communities in the preserve. Red-cockaded woodpeckers (*Picoides borealis*) require old-growth pine forests for nest colony sites; these communities became uncommon after timber cutting in the southeastern United States during the last century. Several colonies occur in Big Cypress, and consideration is given to possible impacts on this bird when planning for burns in these areas. The Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), an endangered bird that resides partly on the southeastern part of Big Cypress, relies on graminoid marshes for nesting. The effect of fire on this community is being studied to determine its possible effects on the marsh and nest site availability. Florida tree snails (*Liguus fasciatus*) reside in hardwood hammocks in Big Cypress. These hammocks are identified so that effects of fires on snails can be minimized.

Cultural resources and controlled fires. Several historic and prehistoric cultural sites have been identified in Big Cypress with help from fire management staff. Sites have been surveyed by NPS Southeast Archeological Center archeologists after burning, when they are more easily located with vegetation removed. Also in early 2003, fire management staff used hand tools to clear a dense stand of exotic Brazilian pepper (*Schinus terebinthifolius*) trees from a Calusa Indian shell mound, so that excavation and artifact recovery could most effectively take place at this archeological site.

Exotic plant removal and habitat restoration. Whenever possible, exotic plant management staff coordinates with fire management staff at Big Cypress to burn areas from which exotic *Melaleuca* (*Melaleuca quinquenervia*) trees have been removed. These areas are burned after the *Melaleuca* seeds have germinated, but before they are large enough to tolerate fires (usually within a year of germination), as recommended by Myers et al. (2001).

USGS long-term fire ecology project. The U.S. Geological Survey (USGS) Biological Resources Division has maintained a field station to study fire effects on hydric and mesic pinelands in Big Cypress for about 20 years. Data gathered from this long-term study will help managers understand what fire frequencies may be appropriate for these woodland communities.

Major Communities and Fire Regimes

Cypress and mixed hardwood swamps.

Cypress and mixed hardwood swamps cover about 50% of Big Cypress. Wade et al. (1980) suggested that these wetland communities are probably more common now than before disturbance by logging, and that pre-drainage fire frequencies may have been 100–200 years in dense cypress sloughs. Myers and Ewel (1990) indicated about 20-year fire intervals in cypress forests. These are communities with long hydroperiods and high humidity, so fires are not well supported here except during times of extreme drought. Fire, however, is apparently important to these communities in maintaining dominance by cypress. Dwarf cypress, an ecotonal community with elements of cypress slough and marl prairie, burn more frequently (see below under “Marl prairies and marshes”).

Wade et al. (1980) provided no estimate for natural fire frequency in mixed cypress and hardwood sloughs, but suggested that the very wet, dense, interior parts of the sloughs probably seldom burn. The edges of these communities that are ecotonal with marl prairies or with mesic pine flatwoods, however, may experience fires as often as the adja-

cent communities, and areas closer to the hydric interior of the slough will experience less frequent fires. As slough community areas typically are linear with little topographic relief, these ecotonal areas can be extensive, but here they are considered outside of the slough and mixed hardwood community. Much variation occurs in mixed hardwood and cypress communities, so that fire frequency is estimated at 50–100 years.

Marl prairies and marshes. Marl prairies and marshes are hydric communities that are dominated by ground cover, and occupy about 20% of Big Cypress National Preserve. Duever et al. (1986) cited works that suggest fires occur in these communities about as often or more often than in pinelands, but indicated that some prairies are less productive than pinelands so that fuel loads may not accumulate fast enough to support more frequent fires. Areas dominated by sawgrass (*Cladium jamaicense*) may burn every 2–5 years, but Wade et al. (1980) cited estimates of pre-disturbance frequency at 3–25 years, suggesting that frequencies near the low end of this estimate may have been most common. These estimates suggest a natural fire frequency of 3–5 years.

Mesic and hydric pine flatwoods. Pine flatwoods communities are mesic-to-hydric communities that are dominated by open-canopied slash pines (*Pinus elliottii*); these communities cover about 20% of Big Cypress National Preserve. Mesic pine flatwoods are usually co-dominated by saw palmetto (*Serenoa repens*) shrubs, and hydric pine flatwoods are usually co-dominated with graminoid ground cover. Myers and Ewel (1990) indicated variation of fire frequencies in these communities with environmental variables. Wade et al. (1980) indicated much variation in pine flatwoods fire frequencies, but pointed out that in closely related pine rockland communities, fire every five or six years was enough to inhibit effective recruitment of pine seedlings, so that natural fire intervals may be greater than seven years. These communities are often adjacent to frequently burning prairies, and may be subject to ignition by those fires, so that more frequent fires can

occur. Duever et al. (1986) cited studies of fire frequencies in pine forests at 3–7 years, and studies that demonstrated succession to hardwood communities after 15–25 years without fire. These estimates suggest a natural fire frequency of 7–20 years.

Mesic hammocks. Mesic hammocks are slightly elevated insular areas that are dominated by hardwood trees. Inland, these tree islands usually are dominated by temperate trees; in coastal areas, by tropical trees. Duever et al. (1986) and Wade et al. (1980) mentioned that hammocks are usually insulated from fires by wetlands that surround the islands; also, hammock soils are usually moist, with water tables within 1 m of the soil surface for most of the year. Duever et al. (1986) conservatively estimated fire frequencies in hardwood hammocks of 50 years or more. Wade et al. (1980) provided no estimated fire frequency, but cited evidence of an interval of 200+ years for fires in hammock interiors.

Seasons and Naturally Occurring Fires

Rainy and dry seasons. Seasons in southern Florida are less defined by temperature than in more northern parts of North America; however, wet and dry seasons produce predictable annual changes. Spring months are usually the driest of the year, followed by the rainy summer season. Daily afternoon thunderstorms begin to build from about mid-May to mid-June and occur through early autumn. Lightning that is part of these storms creates fire activity during the summer rainy season. Wade et al. (1980) indicated that 75% of thunderstorms in southwestern Florida occur from June through September. Duever et al. (1986) indicated May as the month most likely for fires. Records of fires occurring at Big Cypress over the past 20 years indicate that natural fire frequencies are greatest during summer, when thunderstorms are most common. Areas burned by naturally occurring fires are greatest early in the summer when conditions are driest and lightning becomes common (Big Cypress National Preserve Fire Operations 2003).

Plant community activities and fires. A primary ecological consideration for prescribed fires should be the seasonality of naturally occurring fires. Fire may be considered a stochastic event, so that its occurrence involves a statistical likelihood in each community, but the actual time of the event is random. This should not be taken to mean that fires should occur with regularity, but that over time, most fires naturally occur during a particular season, and fewer occur during the rest of the year. In southern Florida, we may consider late spring as a likely season for fires, based on several ecological observations: (1) late spring is usually the driest season; (2) dry conditions occur through much of this season; and (3) afternoon lightning becomes common. Comparing plant activities in several natural communities that are affected differently by fires can partly test this hypothesis.

Methods

Growth and reproduction in plant communities often varies with seasons. Plant communities largely are a function of physical surroundings, so that fires may be considered an important factor in their structure. By looking at flowering plant reproductive activity (flowering), seasons of reproductive activities can be compared with seasons of naturally occurring fires. Reproductive activity is only one factor that should be considered as part of the ecology of communities subject to fire.

Seasonal flowering of vascular plants that are commonly found in four communities in Big Cypress were compared with estimated fire return intervals for each community. The species selected were from lists of plants found in several locations in southern Florida near to and within Big Cypress. The communities selected are marl prairies (118 plants), pine flatwoods (104 plants), mixed hardwood and cypress swamp (119 plants), and tropical hardwood hammocks (130 plants). Seasons of flowering were taken from Wunderlin (1998). Estimates of fire return frequencies were interpreted from several authors (see above, "Major Communities and Fire Regimes"). Fire is assumed to occur most often during spring as a result of lightning from thunder-

storms during dry conditions.

Results and Management Implications

Reproductive activities of plants found in major biological communities in Big Cypress National Preserve varied with estimated naturally occurring fire return frequency. Communities with short fire return intervals had fewer resident plants with reproductive activity during the spring, suggesting that natural fire regimes may influence the species compositions of these communities (Table 1).

Marl prairie communities have the highest fire frequencies with the lowest percentage of plants flowering in spring (dry season), and the highest percentage of those flowering in summer (wet season). Wade et al. (1980) indicated that a fire frequency of 2-5 years is necessary in sawgrass marshes to minimize fuel build-up. Duever et al. (1986) mentioned that low vegetation, burned back to the substrate surface level, can recover well when re-growth occurs before the summer rains. Wade et al. (1980) recommended spring burning for sawgrass, if soils are damp or inundated. This allows fire to remove the dead or old growth, but offers protection of meristem tissues that occur near the soil surface. Frequent prescribed fires (3-5 year intervals) should be considered for these communities.

Pine flatwoods that occur in Big Cypress

also have fire returns of only a few years, similar to adjacent marl prairie communities. These communities represent most of the mesic habitat here, and are important for the success of at least two listed animals (Florida panther and red-cockaded woodpecker) that reside in the preserve. Maintaining these uplands in current successional stages is important for these animals, so that fire frequencies of 7-20 years should be considered for these plant communities.

Mixed cypress and hardwood sloughs and tropical hardwood hammocks are communities that apparently have fire return intervals on the order of decades or centuries. Soils, plants, and hydrology in these communities do not promote fires (Wade et al. 1980; Duever et al. 1986), and the proportions of plant reproductive activities in these communities is higher during times of greater fire probability than in marl prairies or pine flatwoods (Table 1). Hammocks have the longest fire return frequencies, and the greatest percentage of spring-flowering plants. These communities occupy relatively little area in Big Cypress, but contain at least one State of Florida listed animal (Florida tree snail), and many state-listed threatened or endangered plants (mostly epiphytic orchids and bromeliads). Prescribed fire should not be promoted in these communities, as naturally occurring fires apparently were rare.

Table 1. Seasonal flowering of plants and fire frequencies: estimated percentages of flowering plants that produce flowers during each season and year-round in natural communities with different fire frequencies in Big Cypress National Preserve. Seasons of flowering were taken from Wunderlin (1998). Fire is assumed to occur most often during spring, as a result of dry conditions and lightning from thunderstorms.

| | Marl Prairies | Pine Flatwoods | Mixed Swamp | Tropical Hammocks |
|---------------------------------|------------------|-------------------|----------------|----------------------|
| Spring | 53 | 64 | 67 | 87 |
| Summer | 91 | 83 | 79 | 81 |
| Fall | 82 | 74 | 66 | 73 |
| Winter | 22 | 21 | 24 | 44 |
| All Year | 20 | 19 | 22 | 40 |
| <u>Fire</u> <u>Frequency</u> | 3-5 yrs. | 7-20 yrs. | 50-100 yrs. | 100+ yrs. |

Conclusions

The ecology of biological communities should be considered in planning fires. Wade et al. (1980) indicated that 70% of plants endemic to southern Florida occur in pyroclimatic (fire climax) communities, and plant reproductive activities outlined here appear to be related to fire frequencies and seasons. Duever et al. (1986) indicated that out-of-season fires may change life cycles of native plants and animals and may promote growth of some exotics. At Big Cypress, decisions on timing and use of prescribed fire are based on information collected by USGS and NPS scientists on the conditions of natural systems. However, in general, frequencies and timing of prescribed fires largely reflect human requirements. Efforts should be made to set prescribed fires during seasons having conditions most similar to those conducive to naturally occurring fire.

References

- Big Cypress National Preserve Fire Operations. 2003. Unpublished data. Ochopee, Fla.: Big Cypress National Preserve.
- Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.L. Myers, and D.P. Spangler. 1986. *The Big Cypress National Preserve*. Research Report no. 8. New York: National Audubon Society.
- Myers, R.L., H.A. Belles, and J.R. Snyder. 2001. Prescribed fires in the management of *Melaleuca quinquenervia* in subtropical Florida. In *Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species*. (Fire Conference 2000: The First National Congress on Fire Ecology, Prevention, and Management.) K.E.M. Galley and T.P. Wilson, eds. Miscellaneous Publication no. 11. Tallahassee, Fla.: Tall Timbers Research Station, 132-140.
- Myers, R.L., and J.J. Ewel. 1990. *Ecosystems of Florida*. Gainesville: University Press of Florida.
- Wade, D., J. Ewel, and R. Hofstetter. 1980. *Fire in South Florida Ecosystems*. General Technical Report SE-17. Asheville, N.C.: U.S. Department of Agriculture-Forest Service, Southeast Forest Experiment Station.
- Wunderlin, R.P. 1998. *Guide to Vascular Plants of Florida*. Gainesville: University Press of Florida.

