Long-term Experimental Study of Fire Regimes in South Florida Pinelands

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South Florida slash pine forests represent one of the region's most fire-dependent and imperiled ecosystems. Some 65 vascular plant taxa are endemic to southern Florida and more than half are herbs and low shrubs restricted to pine forests. These species are quickly shaded out in the absence of fire. The fire regime that created this system is not fully known. While lightning-ignited fires during the May to July period surely burned substantial areas before the arrival of Europeans, the indigenous people had most likely been burning at other seasons for thousands of years. Even in large natural areas like Everglades National Park, a lightning-driven fire regime cannot be allowed to operate because of human health and safety concerns. Prescribed fire will be required to restore and maintain South Florida pinelands. While restoring the natural fire regime is frequently posed as a restoration goal, a more realistic goal may be to use prescribed fire to restore and maintain the desired species composition and structure of South Florida ecosystems.

This long-term study will document the ecological effects of a wide range of potential fire management strategies on South Florida pinelands. The main objective of the current project is to establish the baseline conditions and begin the experimental treatments for a long-term study of season and frequency of burning in South Florida pinelands. The research will provide detailed data on vegetation responses (such as changes in species composition, biomass, and demography of pines) to different burning regimes that will be considered along with wildlife, public safety, and other management concerns in refining prescribed burning programs on Department of Interior lands in South Florida. Because many of the effects of fire regime will not become evident until after several repetitions of the experimental treatments, this study must be treated as a long-term ecological study. Specific objectives for the initial phase of the long-term study include: 1) describing the vascular plant communities of all treatment units to document initial conditions, 2) conducting all the initial experimental burning treatments, 3) documenting the short-term effects (<1 year) of season of burning and fire intensity on selected vegetation parameters, and 4) institutionalizing burning and data collection schedules and protocols for study of long-term effects of season and frequency of burning.

The experimental study has been set up in eastern Big Cypress National Preserve, where the most extensive unlogged stands of South Florida slash pine (*Pinus elliottii* var. *densa*) remain. The pinelands exist as a mosaic of slightly elevated "islands" within a matrix of cypress domes and dwarf cypress prairies. The substrate is a shallow layer of sand over limestone bedrock, making these pinelands transitional between the true rockland pine forests of the Miami Rock Ridge and the widespread pine flatwoods to the north. The study site of 2573 ha surrounds the Raccoon Point oil field and is divided into 18 experimental burn units. Each burn unit includes at least 50 ha of pine forest. Within each unit, three permanent 1.0 ha tree plots were established. In each plot, trees with diameter at breast height (dbh) >5.0 cm are tagged and mapped. Smaller 0.1 ha vegetation plots are located in the center of each tree plot and at two additional locations in each unit to sample herbaceous and shrubby vegetation. There are a total of 54 tree plots and 90 vegetation plots. The tree plots (containing a total of 16,370 trees) show the Raccoon Point pinelands to have average stand densities (trees/ha) of 227 pines, 53 cabbage palms, and 24 cypress. All but five of the tree

plots contain at least one cypress tree, indicating the hydric nature of these pinelands. The understory vegetation also is frequently dominated by wetland indicators.

The experimental treatments consist of burning at three seasons (spring, or early wet season, when the largest human-caused or lightning-caused wildfires occur; summer, or mid wet season when there are frequent, but generally small, lightning-ignited fires; and winter, or mid dry season when conditions are frequently favorable for prescribed burning) and two frequencies (every 3 years and every 6 years) for a total of six treatment combinations. Each treatment is replicated three times, with one replicate being burned per year for three years. The project is a cooperative effort of the USGS and the NPS and all the experimental prescribed burns are conducted by the Big Cypress National Preserve Fire Management Division. Beginning in 1996, two units have been burned at each season, representing both short- and long-frequency treatments. Some treatment burns have been postponed to subsequent years because of abnormally wet conditions or because of state-wide burning bans brought on by drought conditions. By spring 2000, all 18 of the initial experimental prescribed burns were completed and the second cycle of burns of the 3-year treatments was begun.

The severity of each burn is quantified several ways, because fire behavior may vary significantly within a given treatment. Fuel consumption is measured by collecting 50 fuel samples before and after each burn. Fire temperature is measured by placing in the plots 148 small steel plates with spots of temperature-sensitive paints. And lastly, the proportion of scorched needles and the height of bark charring on the stem of each pine tree is measured after the burn. Tree mortality is evaluated one year after burning.

Based on the data from the first 16 burns, fuel loadings average 1055 g/m^2. Fine litter, dominated by pine needles, comprised 78% of the mass consumed while herbs, palms, and coarse litter (>0.6 cm and <2.5 cm in diameter) each made up 5 to 10%. Fuel consumption averaged 717 g/m^2 and was lowest during the mid wet-season burns. Fire temperatures were relatively mild, with means ranging from a low of 212^oC during mid wet-season burns to a high of 222^oC after early wet-season burns. Mortality of pine trees >5 cm diameter in the first year after the burns was very low, including trees in which all the needles were scorched. The greatest number of trees (2.9%) died after mid wet-season burns. South Florida slash pine is extremely resistant to fire at any season. Patterns of mortality are often associated with localized fuel conditions rather than season of burning. Results to date do not support the argument that all prescribed burning should be done during the lightning-fire season.

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