

# **HIGH INTENSITY PRESCRIBED FIRE TO MAINTAIN SPARTINA MARSH AT THE URBAN-WILDLAND INTERFACE**

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## **ABSTRACT**

The Sanibel-Captiva Conservation Foundation (SCCF) is using high-intensity fire to perpetuate fresh-water marsh on Sanibel Island. Shrubs are invading the marsh because of the decreased hydroperiod. A policy of fire exclusion was followed until 1971 when a destructive wildfire occurred during an extreme drought. This event demonstrated the potential of fire for vegetation management, turning SCCF policy from fire exclusion to prescribed burning. Subsequent construction of the SCCF headquarters-museum complex at the edge of the marsh and the decision not to use constructed firebreaks put the future of the prescribed fire program in jeopardy. These constraints were overcome and the marsh was again successfully burned with a high-intensity prescribed fire. The area now serves as an operational-scale demonstration area where museum visitors can see firsthand how the intentional use of fire can accomplish resource management objectives while mimicking natural perturbations in an environmentally acceptable manner.

## **INTRODUCTION**

You might be surprised to find high-intensity prescribed fire intentionally used at the urban/wildland interface, and even more surprised to find it used on Sanibel Island. A large barrier island off the coast of southwest Florida, Sanibel is known as a retirement mecca of the more affluent; its condominiums and resorts cater to the more discriminating tourist. This island is also home to the Sanibel-Captiva Conservation Foundation (SCCF), a nonprofit organization attempting to rehabilitate and preserve a cross section of the island's fresh-water wetlands. This wetland ecosystem is actually a series of marshy swales along the Sanibel River that are separated by slightly elevated shell ridges (ancient shorelines) containing shrub and subtropical hardwood plant communities.

Historically, the interaction among freezing temperatures, hurricanes, and fire shaped and maintained the diverse vegetative mosaic throughout south Florida. Discovery and subsequent development of Sanibel have drastically changed its environment. The swales no longer remain flooded well into the winter dry season. Drainage and channelization, coupled with the ever increasing water demands of the populace, now keep the water table below

ground surface for long periods. The once dominant sawgrass (*Cladium jamaicensis*) gave way to the more xeric spartina (*Spartina bakerii*) or cordgrass, as it is commonly called. The marshes are being invaded by even less water-demanding shrubs including saltbush (*Baccharis halimifolia*), wax myrtle (*Myrica cerifera*) and that ubiquitous exotic, Brazilian-pepper (*Schinus terebinthifolia*).

Until 1971, a strict fire suppression policy was followed on SCCF land. Colonization of the marsh by brush was well underway when the inevitable wildfire swept over a large portion of the SCCF holdings during the severe drought of 1971. This fire not only cleared the invading brush from the marshy swales, it also top-killed most of the shrubs and subtropical trees on the shell ridges. The deeply charred trunks of cabbage palms (*Sabal palmetto*), the only trees to survive the fire in appreciable numbers, attest to the intensity of the wildfire.

As the marsh revitalized during the ensuing months, some members of the SCCF envisioned the potential usefulness of this powerful natural tool. If the shell ridges could somehow be protected, perhaps wet-season fires could again periodically sweep these swales, top-killing the encroaching brush and giving the cordgrass, which resprouts from tussocks, a head start toward recapturing the area. Moreover, the hazard of a dry-season wildfire would be virtually eliminated for several years until the succulent grass regrowth matured and dead material again began to accumulate.

## THE PRESCRIBED FIRE PROGRAM

Determining the correct mix of fuel, weather, and fire variables to ensure the safe use of fire at this urban/wildland interface was a difficult task, however. The 1971 wildfire demonstrated that none of the SCCF plant communities were immune to fire. But it also demonstrated the resiliency of these communities. After 4 years, the only obvious indicators of this disturbance were snags of several large Australian pine (*Casuarina equisetifolia*) (a naturalized exotic) and the deeply charred trunks of one of the most fire-tolerant American trees, cabbage-palm, which dominated many of the shell ridges. Lush regrowth hid those brush skeletons still standing. In fact, brush encroachment into the marshy swales was again becoming serious. Cordgrass fuel accumulation and decomposition had reached an equilibrium weight of about 17 tons per acre.

SCCF personnel worried about the next wildfire and what measures could be taken to prevent, or at least mitigate its effects. After much discussion, they settled on prescribed fire as the most viable, environmentally acceptable idea. The SCCF Board of Directors asked the U.S. Forest Service for assistance in planning and executing a prescribed burn. Fire protection of this area is vested with the Florida Division of Forestry and its expertise and involvement was utilized from the initial planning stage. The SCCF Board approved

the completed burning plan with the stipulation that extensive firebreaks not be constructed. Although not part of our original plan, it appeared that the damper microclimate and lack of litter fuels within the dense shrub zone separating the marsh community from the shell ridge ecosystem could be utilized to hold the fire under certain burning conditions. But just in case, our contingency plan included deployment of hand crews along the shell ridge, ground tankers along the adjacent major island highway, and a small retardant plane over the fire.

We contacted the sheriff's department regarding possible traffic congestion at the burn site and asked that they also be prepared for the unlikely occurrence of reduced visibility along this thoroughfare. The wind direction necessary to minimize the effect of smoke on nearby populated areas would transport the plume across the road which passes within several hundred feet of the proposed burn. We calculated that ground-level wind speeds below 8 mph would allow convective activity of the fire to lift the smoke to sufficient heights before it crossed the road. The prescription with its attendant smoke management plan was presented to the Sanibel City Council, which approved it and gave the required permit. Sanibel Island lies in a designated smoke sensitive area, so we also notified the Florida Department of Environmental Regulation of our intentions.

Because the specter of the 1971 wildfire was still fresh in the minds of many people, SCCF personnel mounted a public relations campaign to inform people of the differences between wildfire and prescribed fire in general, as well as the specific objectives of this upcoming fire. The campaign included feature stories in the island newspapers, talks to various clubs and organizations, a brochure for interested visitors, and personal contact with individuals and groups that might oppose the burn to get them involved and hopefully gain their support. These efforts were highly successful. Many people remained skeptical, but they voiced their concerns in a dignified manner and were willing to give the SCCF the opportunity to proceed.

## RESULTS

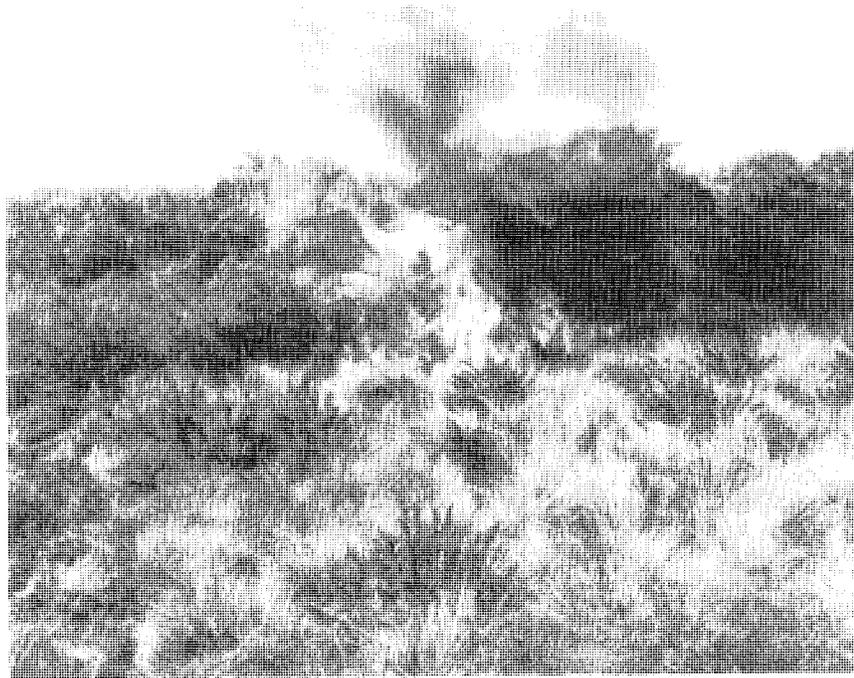
Marshes usually have a very high fine fuel loading (material less than 0.25 inch in diameter) and this one was no exception, containing approximately 35,000 lb/acre of this material. We predicted that the marsh would burn very rapidly and very hot, producing a spectacular but short-lived pyrotechnic display.

This is exactly what happened when we burned the marsh in September 1976. Moisture content of the fine fuels was rapidly dropping by 10 AM. The marsh would not carry a backing fire, but a heading fire was a different story. A 25-foot-high flame front raced across the swale, hit the shrub ecotone, dropped to the ground, and required very little mop-up. The smoke crossed the highway several hundred feet above the traffic. Spotting was not a

problem because of the high humidity. Virtually no smoldering combustion took place and the fire was out 30 minutes after ignition. Fireline intensity was calculated to be over 3,000 BTUs per second per foot of fire front—about three times that of most wildfires. The spartina and virtually all live shrub material less than 0.25 inch in diameter were consumed, but unlike the 1971 wildfire, which exposed the underlying soil, this one left about 2,000 lb/acre of damp litter and provided refuge for the smaller, less mobile animals, as it passed overhead. All weather parameters remained in site prescription limits throughout the burn. At ignition time, the ambient temperature was 87 °F, the relative humidity 70 percent, and “ground level” wind 2-3 mph from the southeast.

Regrowth in the marsh was rapid. Within a month the spartina regrowth was over a foot high and some leather fern (*Acrostichum* spp.) fronds exceeded 3.5 feet tall. Two months after the burn about 75 percent of the saltbush (the most abundant shrub) had resprouted. Although multiple sprouts were the norm, by the following spring many had died leaving only 1 or 2 sprouts per original stem. In a few cases all had died.

Many of the local residents and tourists that visited the marsh in the months following the burn were interviewed. Some thought the long-term consequences of the burn might prove to be harmful, but an overwhelming majority thought the burn was a success and had accomplished its objectives.



**This high intensity prescribed headfire was ignited to control shrub encroachment into a spartina swale on Sanibel Island, Florida.**

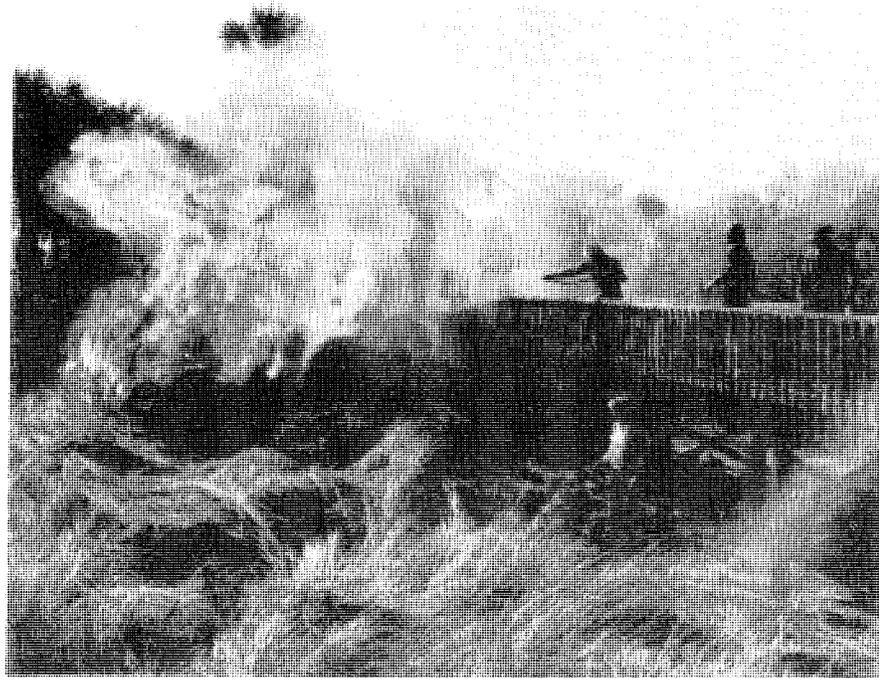
This would be the end of the story except that 1 year after the burn, the SCCF constructed a several-hundred-thousand-dollar headquarters-museum complex and boardwalk on the site. The Foundation's decision to maintain the native vegetation right up to these structures rather than establish a permanent fire break adjacent to them resulted in a visually pleasing scene, but it made the complex extremely vulnerable to fire. Thus, the need to manage these fuels assumed ever greater importance while the actual burning job became that much more difficult to safely accomplish.

By the summer of 1980, fuel loadings in the marsh had again become intolerable. The SCCF Board of Directors once again approached the U.S. Forest Service for assistance in conducting the burn utilizing the same fuel type boundaries as in 1976. Three additional precautions were taken this time because there was now a building complex at the edge of the burn area and the attached boardwalk spanned the marshy swale itself. First, the Sanibel and Captiva fire stations were asked to stand by on the day of the burn to wet down the buildings and boardwalk as necessary. This would also provide an excellent training opportunity for them to observe wildland fire behavior. Second, a 5- to 6-foot-wide swath of cordgrass was cut back from the complex several days before the scheduled burn. And third, the prescription was revised to produce a less intense fire.

On December 3, 1980, the daily throng of visitors at the Sanibel marsh were given the opportunity to watch one of nature's most awesome phenomena, a high intensity fire—in this case being manipulated to accomplish planned objectives. The water table in the marsh was ideal, just below the ground surface. A final weather check revealed weather conditions were forecast to stay within the range specified by the burn plan: relative humidity above 60 percent and average wind velocity less than 8 mph from the northeast. By the time the first match was struck at midmorning, the sun had evaporated much of the dew that had formed the night before. The fire was ignited so that it would flank into the wind rather than run with it. This resulted in somewhat lower flame lengths and a slower rate of spread than in 1976, but allowed a higher degree of control. The flames quickly rose to a height of 14 to 16 feet and the fire moved across the swale in spectacular fashion. As in 1976, the advancing flame front dropped to the ground upon hitting the surrounding wet shrub ecotone and went out. As the fire approached the building complex and boardwalk, its intensity was regulated by the judicious use of water from two garden hoses stretched along the boardwalk.

Within half an hour, the visitors were allowed back on the boardwalk to view the drastically altered environment. Gone was the barely penetrable jungle of 5-foot-high cordgrass, vines, and brush that had developed in the 4 years since the last fire. All that remained were the skeletons of the larger shrub invaders and about 4,000 lb/acre of litter that was too wet to burn.

This scene of apparent devastation was short lived. Within days, the burned area was carpeted with a profusion of bright-green shoots originating from the cordgrass tussocks, virtually all of which survived the fire. Many of the



**Cooling down a high intensity prescribed fire set to reduce wildfire hazard and control exotic species encroachment in a spartina marsh on Sanibel Island, 4 years after the last burn. Approximately 16 tons of fuel per acre are being consumed.**

shrub rootstocks also survived the fire, but they were not as quick to resprout and thus could not effectively compete for the wealth of nutrients made available by the fire.

Within 6 months the cordgrass was waist high. By the end of the first year the fire-released nutrients had been incorporated; the cordgrass was beginning to mature—its juvenile turgid stems had hardened off and some shoot dieback was noticeable. From this stage of development onward, the marsh becomes increasingly flammable. During the second year, brush sprouts from rootstocks that survived the fire become visible above the cordgrass. Other postfire invaders give the spartina serious competition by the end of the third year. Fire is again needed to rejuvenate the marsh and set back the encroaching brush.

Visitors to the SCCF can see firsthand as these changes take place. The dramatic increase in the abundance and species diversity of wildlife, especially birds, for several years after a burn is striking. As people walk the nature trails, the visual differences between burned swales in various stages of recovery and adjacent unburned swales clogged with brush and little-used by wildlife, provide an excellent demonstration of the successful use of prescribed high-intensity fire at the urban/wildland interface to perpetuate this ecosystem.