UF IFAS Extension UNIVERSITY of FLORIDA

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FOR407

https://doi.org/10.32473/edis-FR478-2024

The Fire Ecology of Saw Palmetto[1]

By Vânia Maria Pereira, Thiago Souza Campos, Wagner Vendrame, and Raelene M. Crandall[2]

This publication informs fire managers, natural resources managers, and interested individuals about the relationship between saw palmetto and fire. Saw palmetto (*Serenoa repens* Bartr.) is a palm native to the southeastern United States and found in peninsular Florida, southern South Carolina, and southeastern Louisiana. It has two geographically segregated forms: the green form occurring inland and the silver form on Florida's east coast (Carrington and Mullahey 2006; Hilmon 1968; Maehr and Layne 1996). It occurs across many ecosystems that vary in soil moisture, such as mesic and scrubby flatwoods, mesic to xeric hammocks, xeric sandhills, coastal strands, dry prairies, and pine rocklands (FNAI 2010). Saw palmetto plants are low-growing bushes, ranging from 2 to 8 ft tall (0.6 to 2.4 m), with large, palmate, fan-shaped leaves (Gilman 2015). What appear to be stems are actually rhizomes, a specialized form of stems that grow near or below ground (Figure 1) (Hartmann et al. 2018). These rhizomes produce large flowering stalks, also called inflorescences, that can grow up to 3 ft (0.9 m) long (Gilman 2015).

Native Florida palms have fire-related traits, allowing them to persist in frequently burned environments (Abrahamson et al. 2023). Saw palmetto is a highly flammable species that comprises a significant part of Florida's fire landscape (Foster and Schmalzer 2012). After fires, saw palmettos exhibit increased growth, resprouting, and flowering (Abrahamson 1999; Carrington et al. 2000; Hilmon 1968; Hilmon and Hughes 1965). Saw palmettos can survive fires because of their well-insulated buds hidden inside waxy leaves (Figure 2) (Maehr and Layne 1996). The meristem, where new growth originates, is located inside the top of the rhizome. Younger leaves grow closer to the center, and older leaves further out, like the layers of an onion (Fisher and Tomlinson 1973). The older leaves persist over time, providing insulation and protection to the meristem (Figure 2) (Henderson et al. 1995; Tomlinson 1990).

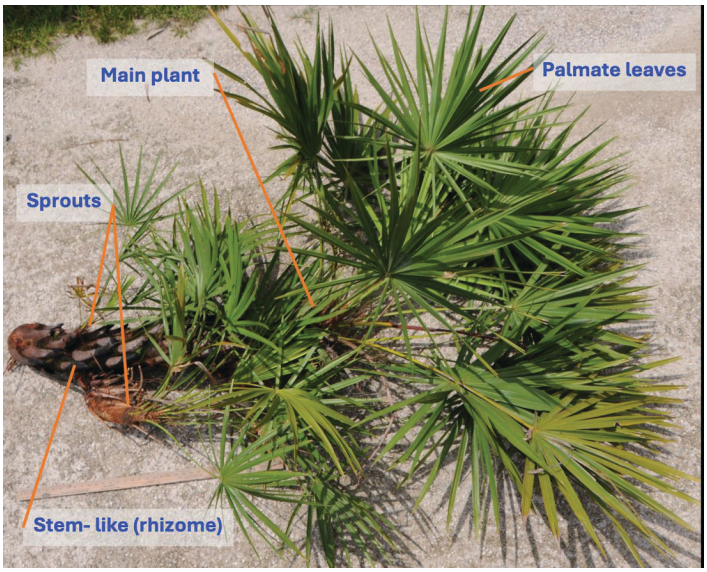

Figure 1. Morphology of saw palmetto plants, including palmate leaves, stem-like rhizome, and vegetative propagation by sprouts. Wooden ruler added for scale.
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1. This document is FOR407, one of a series of the School of Forest, Fisheries, and Geomatics Sciences, UF/IFAS Extension. Original publication date November 2024. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

2. Vânia Maria Pereira, graduate student, Department of Environmental Horticulture; Thiago Souza Campos, graduate student, Department of Agricultural and Veterinary Sciences, Jaboticabal, SP, Brazil; Wagner Vendrame, professor, micropropagation, Department of Environmental Horticulture; and Raelene M. Crandall, assistant professor, fire science, School of Forest, Fisheries, and Geomatics Sciences; UF/IFAS Extension, Gainesville, Florida 32611.

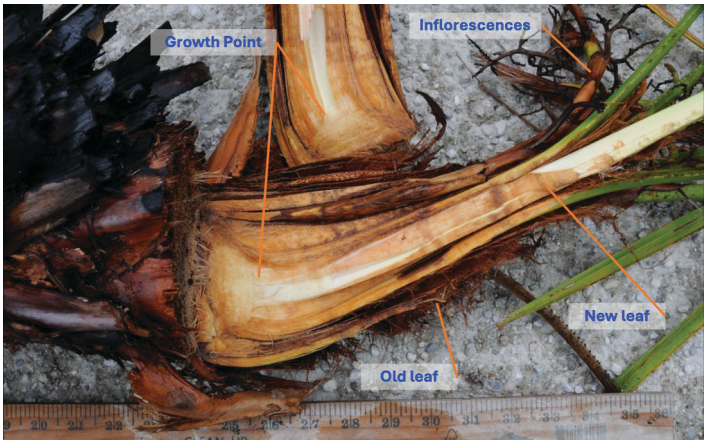

Figure 2. The meristem or growth point is protected by new and old leaves and inflorescence attached to the rhizome.
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Fire Effects on Saw Palmetto

Carbohydrate reserves change.

Fires affect the carbohydrate reserves in saw palmettos. Following a winter burn in a long-unburned, mixed stand of slash pine and longleaf pine, saw palmettos showed a decrease in starch content and increased sugar levels. This suggests that saw palmetto uses sugars for plant regrowth. Four years after the fire, the starch and sugar levels returned to the levels found in unburned plants (Hough 1968). Saw palmetto resilience to fire and rapid resprouting has been associated with its extensive underground carbohydrate reserves stored in the rhizomes as well as with the extensive rhizome water content of 90% of fresh mass (fresh mass being the living, green plant tissue, as opposed to dead, dry leaves) (Abrahamson 1999; Diaz-Toribio and Putz 2021; Orzell et al. 2024).

Plant growth increases.

After fires, new leaves on saw palmetto plants are apparent within 7 to 14 days (Orzell et al. 2024). Within 1–2 years after the fire, plants that have been burned contain more than double the number of leaves of unburned plants. Burns occurring during the winter dry season prompt immediate leaf growth, which is typically slow during winter. This surge in new leaves significantly enhances the plants' photosynthetic capacity and their accumulation of carbohydrate reserves (Abrahamson and Abrahamson 2006). In oak-saw palmetto scrub environments, saw palmetto can return to its pre-burn height, over 1.64 feet (0.5 m), within one year, exhibiting high recovery rates and increased dominance (Schmalzer and Hinkle 1992). Fire also stimulates growth and vegetative reproduction by new sprouts, the primary method of plant spread. In other words, new individuals are formed along pre-existing rhizomes (Figure 3) (Hilmon 1968).

Fire triggers flowering.

Saw palmetto typically flowers from March through May, independently of fire (Hilmon 1968). However, flowering is minimal in unburned areas where the overstory is dense (Abrahamson 1999). Fire during winter or summer seasons causes more plants to flower in the first year after fire than would flower without fire (Abrahamson 1999; Blonder et al. 2018; M. E. Carrington and J. J. Mullahey 2006; Carrington and Mullahey 2013). The production of flowers after a fire depends on plant size and light availability, as fire also reduces overstory canopy and increases light availability (Abrahamson 1999).


Figure 3. New growth and vegetative reproduction by sprouts on saw palmetto plants 30 days after summer fire.
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Saw Palmetto Effects on Fire

Saw palmetto's flammable leaves fuel fire.

Fires are fueled by saw palmetto's highly combustible dead leaves (Carrington et al. 2000). With its high biomass of live and dead foliage, saw palmetto creates a greater wildfire hazard than other shrubs and small trees growing between the forest canopy and the forest floor (Behm et al. 2004). Although the leaves do not reach high temperatures during a fire, leaf consumption is high (Figure 4), and the time to ignition is shorter than that of other common Florida understory species. This results from the higher litter depth typically found under saw palmetto plants, leaves positioned closer to the litter surface, and lower foliar moisture content (Figure 5) (Behm et al. 2004). The low fuel moisture in dead leaves, even after a short-term rainfall, has been associated with the position of the dead leaves. Dead leaves lie under living leaves, which have a waxy coating that prevents rain from wetting the dead leaves (Figure 5) (Hiers et al. 2019). Dense patches of saw palmetto can, therefore, greatly increase fire intensity (Platt 1999).

Figure 4. Inflorescence production and new growth 30 days after a winter prescribed burn that consumed all leaves.
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Figure 5. Living leaves positioned over and deflecting rain from dead leaves (A); positioning of dead leaves close to the litter covering the forest floor (B).
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Saw Palmetto and Fire: Best Management Practices

Control fuels.

In long-unburned areas with high fuel loads, managers commonly manipulate fuels to reduce fire hazards and enhance the safety of prescribed burning. Mechanical mastication, the mowing, shredding, or chipping of understory plants such as saw palmetto, is often used to restructure the understory fuel height. This practice does not reduce fuel loads but alters and rearranges the structure of the fuel bed, decreasing its height and increasing its density (Kreye et al. 2015). A lower, denser bed of understory fuel has been shown to decrease flame heights by 66%. When using mastication, it's advised to ignite prescribed burns soon afterward and to choose a time when the soil moisture is high. Wet soils reduce the likelihood of high soil temperatures during burns. Greater fuel bed density can increase soil temperatures, which could hurt or kill nearby plants, namely pine trees, especially if the soil is dry (Kreye and Kobziar 2015). The loss of shrub cover on longleaf pine flatwoods by mowing has been shown to increase the drying of surface fuels, whereas the increase in bulk density can increase the ignition probability (Budny et al. 2014).

Due to the rapid regrowth of shrubs, such as saw palmetto, following disturbances, fuel restructuring is only effective in the short term. After mastication, the post-treatment fuel reduction burns should occur within six months (Kreye and Kobziar 2015; Kreye et al. 2014). For fuel control in longleaf pine flatwoods, follow-up prescribed burning after mowing should occur within one year (Budny et al. 2014). Prescribed fire alone is also an effective management practice to control saw palmetto, but it needs to be applied recurrently every 3–5 years in mesic pine savannas (Brose and Wade 2002). If mastication kills saw palmettos, the loss will likely be long-term. Saw palmetto rarely reestablishes via seeds.

Effective management of high fuel loads is crucial to prevent severe wildfires, which can kill plants, including saw palmetto. In 2013, an intense fire spread through long-unburned sand pine scrub, an area that had remained fire-free for eight decades. The temperatures reached during this fire exceeded the melting point of aluminum (660°C or 1220°F), with retention times that caused aluminum research tags to melt. Seven smaller saw palmetto plants died due to the intense heat. The saw palmetto mortality was linked to several factors, including the high fuel load, dense shading of the plants before the fire, and the size of the plants, which were smaller with limited reserves for resprouting. The loss of saw palmetto highlights the importance of implementing prescribed burning as part of fire management strategies to prevent severe fires and preserve plant species (Abrahamson et al. 2023).

Schedule burns to aid flower and fruit production.

Saw palmetto fruits are widely used as phytotherapy for prostate cancer prevention in European and American markets. Due to the high demand for fruits in medicinal

markets, interest in the supply chain has increased over the years, and saw palmetto's relationship with fire has been a major area of research.

In central and southwest Florida, Carrington and Mullahey (2006) found that the timing and frequency of burns affect how much saw palmetto flowers after fire. The percentage of plants in the study area producing flowering stalks was greater in the period after fire. After burns during the growing seasons (April to July), saw palmetto plants had a 50% flowering rate one year later. However, only 15% of plants flowered in the second year after fire. For burns during the winter (November to February), about 21% and 28% of plants flowered in the first and second years after the fire, respectively. Saw palmetto flowers in April and May, around 9 to 12 months after growing season burns and 2 to 5 months after winter burns (Carrington and Mullahey 2006). Researchers examined whether fire frequency affects the amount of flowering after summer burns. They found that in pine flat woods and dry prairies of Florida, burning every five years promotes more flowering and fruiting than every 2–3 years. It should be noted, however, that this study did not examine winter burns (Carrington and Mullahey 2013).

The flowering of saw palmetto can be influenced by factors other than the seasonality and frequency of fires. For instance, flowering can vary across ecosystems. Abrahamson (1999) examined flowering patterns in multiple ecosystems, from xeric scrub to xeric sandhill and mesic flatwoods along the Lake Wales Ridge. He found that the flowering of saw palmetto was affected by burn season (January to July fires) and the frequency of burns (three in 8 years). It was additionally affected by plant size, crown loss to fire, and light availability (Abrahamson 1999). The increase in flowering after fires, however, did not always translate to high fruit production. Saw palmetto is notoriously difficult to predict, and the harvest of saw palmetto fruits is highly variable. Fruiting can be inhibited by a multitude of external factors such as caterpillar predation (*Litoprosopus futilis* Grote and Robinson) and fungal infection (*Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc.) (Carrington et al. 2001).

Figure 6. Top, before fire. Saw palmetto is a key plant in Florida ecosystems. The dead leaves are highly combustible because of their low moisture content. Middle, during fire. The dead leaves that remain at the bases of saw palmettos ignite quickly. The heat from burning leaves dries and removes the waxy cuticle from the living leaves above, facilitating ignition and movement of the fire across the entire plant. Bottom, after fire. Saw palmetto is frequently the first plant to resprout after fires, producing abundant inflorescences after summer fires.
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Did you know?

- This long-lived palm is estimated to persist for 10,000 years or longer (Takahashi et al. 2011).
- Saw palmetto is an ornamental plant and a source of food for Florida wildlife. It is used for many products, including honey, fiber, oil, wax, roof thatch, and medicines (Bennett and Hicklin 1998).

- Over 300 insect species have been observed visiting saw palmetto flowers (Deyrup and Deyrup 2012).
- Saw palmetto is a crucial cover for Florida panthers and black bears when they give birth to their young. After birth, mammal offspring use the plants for food and shelter (Maehr and Layne 1996).
- Saw palmetto is predicted to stay within its current range despite a slight increase of suitable habitat to the northeast of its US range (based on climate change predictions to 2070) (Butler and Larson 2020).

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