2B.7 THE EFFECT OF SEASON OF FIRE ON THE RECOVERY OF FLORIDA SCRUB

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1. ABSTRACT*

Florida scrub is a xeromorphic shrubland that is maintained by frequent fires. Historically, these fires occurred during the summer due to lightning ignition. Today, Florida scrub is often managed by the use of prescribed burning. Prescribed burning of scrub has been implemented on Kennedy Space Center/Merritt Island National Wildlife Refuge (KSC/MINWR) since 1981, with burns being carried out throughout the year. The impacts of the season of burn on recovery are not known. Long-term monitoring of scrub regeneration has been conducted since the early-1980's at KSC/MINWR using permanent 15 m line-intercept transects. We obtained data from eight transects that were subjected to a winter burn in 1986 and a summer burn in 1997 and compared the recovery of the stand for the first five years postburn. There was no difference in height growth between the winter and summer burns; both were approximately 85 cm tall five years postburn. Initially, the summer burn had a larger percentage of bare ground, but within a year postburn the amount of bare ground was similar. Total percent cover (> 0.5m) was lower during the recovery from the 1997 summer burn than from the winter burn, whereas total percent cover (< 0.5m) was greater. The post-fire growth response of the majority of the dominant species was similar for the winter and summer burns. For example, the reestablishment of cover of the dominant oak, *Quercus myrtifolia*, did not differ following the winter and summer burns. However for the first year postburn, *Serenoa repens* had a significantly lower percent cover following the summer burn than the winter burn.

2. INTRODUCTION

Florida scrub is a rare and declining ecosystem (Myers 1990, Menges 1999) characterized by evergreen, xeromorphic shrubs including oaks (*Quercus* spp.), repent palms (*Serenoa repens, Sabal etonia*), and ericaceous shrubs (*Lyonia* spp., *Vaccinium* spp.). Scrub ecosystems vary regionally (Myers 1990, Schmalzer et al. 1999) and along local environmental gradients (Abrahamson et al. 1984, Schmalzer and Hinkle 1992b). Specific types of scrub include sand pine scrub, oak scrub, rosemary scrub, and scrubby flatwoods (Myers 1990, Abrahamson and Hartnett 1990).

Florida scrub is habitat for threatened and endangered plants and animals (Christman and Judd 1990, Stout and Marion 1993, Stout 2001). Management of remaining scrub is critical to the survival of these species. Scrub is a fire-maintained system (Myers 1990, Menges 1999), and recovery after fire of oak scrub and scrubby flatwoods is primarily through sprouting and, in some species, clonal spread of the dominant shrubs (Abrahamson 1984a, 1984b, Schmalzer and Hinkle 1992a, Menges and Hawkes 1998). Scrub naturally burned during the summer months due to lightning ignition. However, landscape fragmentation and fire suppression have reduced fire size and frequency (Myers 1990, Duncan and Schmalzer 2001). Prescribed burning is the primary management technique for scrub reserves (Menges 1999). Understanding the effect of season of fire on the recovery of Florida scrub is important to management decisions. In this study, we compare how community composition and structure reestablish in the five years following a winter and summer burn.

3. METHODS

This study was conducted in an inland area on the central part of Kennedy Space Center/Merritt Island National Wildlife Refuge (KSC/MINWR) on the east coast of central Florida (28°38'N, 80°42'W). The climate is warm and humid; precipitation averages 131 cm/yr, but year-to-year variability is high (Mailander 1990). The winters are usually dry, and in the summer thunderstorms are common. Scrub at this site occurs on Pomello sand (Arenic Haplohumod), a moderately well drained, sandy, acid soil (Huckle et al. 1974) low in nutrients (Schmalzer and Hinkle 1992b, 1996, Schmalzer et al. 2001). The scrub type represented here is oak-saw palmetto scrub; this is the predominant scrub type on KSC/MINWR (Schmalzer et al. 1999). The dominant species are *Quercus myrtifolia* Willd. (myrtle oak), *Quercus geminata* Small (sand live oak), *Quercus chapmanii* Sarg. (Chapman oak), *Serenoa repens* (W. Bartram) Small (saw palmetto), and ericaceous shrubs (e.g., *Lyonia* spp.) (Schmalzer and Hinkle 1992a, 1992b).

Long-term vegetation transects were established in the Happy Creek area of KSC/MIWNR (Figure 1) in 1983. Eight 15 m line-intercept transects in this area were subjected to a winter burn in December 1986 and a summer burn in June 1997. The transects were

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sampled twice a year for the first three years postburn and then annually. Data collected included the cover of vascular plants (to the nearest 5 cm) by species in two strata; 0.0 – 0.5 m and > 0.5 m (Muellller-Dombois and Ellenberg 1974); and vegetation height at four points (0, 5, 10, and 15 m) along the transect. Bare ground was recorded when there was no plant cover in either height strata. This study was limited to comparisons of the height and vegetation cover data for the first 60 months postburn.

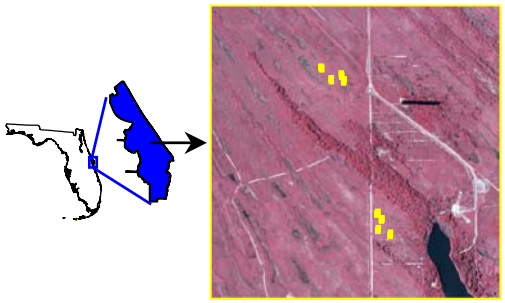

Figure 1: Study site location

The data were analyzed using SPSS 10.0 (SPSS, Inc. 1999). Analysis of Covariance (ANCOVA) was used to determine if height growth and reestablishment of vegetation cover differed between the winter and summer burns. Paired T-Tests were used to determine if differences in reestablishment existed for a species at a specific time postburn, and to determine if a species had reached or exceeded the preburn cover by 60 months postburn.

4. RESULTS

The height of the stand before the winter burn in 1986 was similar to the height before the 1997 summer burn (107.9 ± 6.7 cm and 114.7 ± 9.6 cm, respectively) (Figure 2). The height growth during the recovery of these two burns did not differ (ANCOVA; p = 0.064), with the height reaching approximately 85 cm five years postburn.

Preburn species composition was similar before the winter and summer burns (Figures 3 and 4). The dominant species were *Quercus myrtifolia* and *Serenoa repens*, which comprised 60 – 70% of the total cover. *Serenoa repens* was the only species with a significant difference in percent cover, with a higher percent cover preceding the 1997 summer burn.

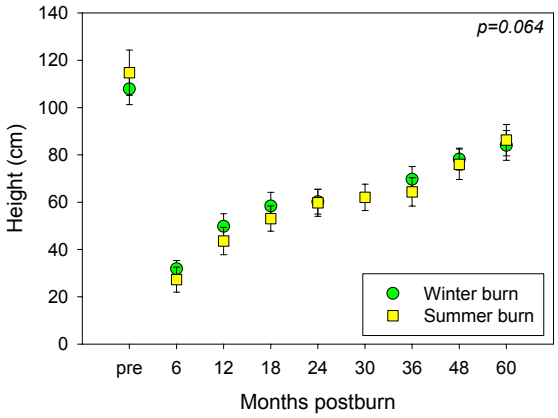

Figure 2: Height growth comparison of the winter and summer burn recovery periods. Data are means and error bars are standard error.

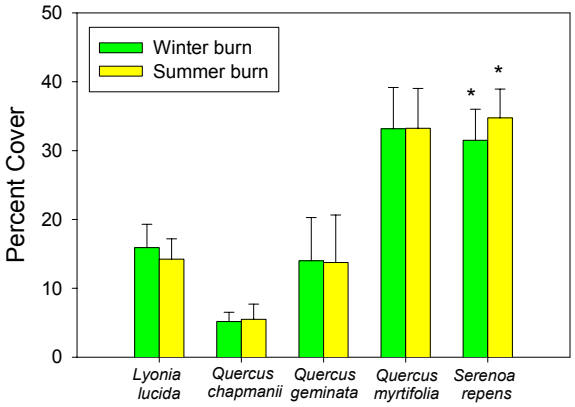

Figure 3: Composition of the major species before the winter and summer burns. Data are means and error bars are standard error.

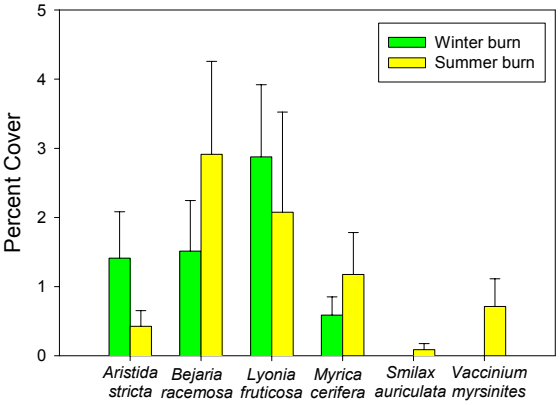

Figure 4: Composition of the minor species before the winter and summer burns. Data are means and error bars are standard error.

The composition five years (60 months) postburn was similar between the recovery from the winter and summer burns (Figures 5 and 6). Two species showed a significantly higher percent cover following the winter burn, *Lyonia lucida* and *Aristida stricta*. Most species had returned to their preburn composition by 60 months postburn. For example, in 1985 the cover of *Serenoa repens* was 31.5 ± 4.5 % and 32.4 ± 5.0 % in 1992.

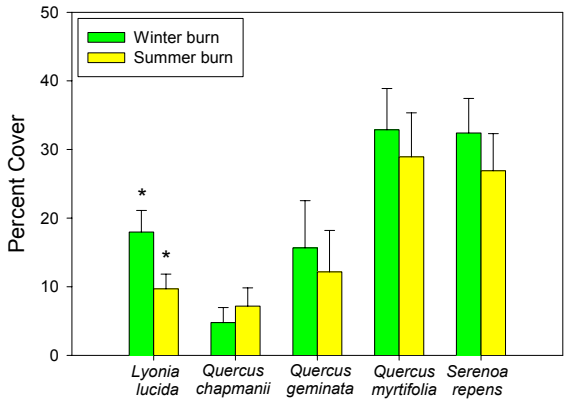

Figure 5: Composition of the major species 60 months postburn for the winter and summer burn recovery. Data are means and error bars are standard error.

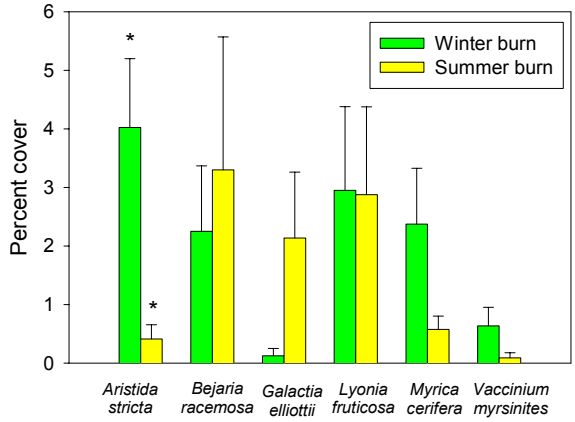

Figure 6: Composition of the minor species 60 months postburn for the winter and summer burn recovery. Data are means and error bars are standard error.

Total percent cover in the greater than 0.5 m strata was similar before the winter and summer burns (106.1 ± 4.7 % and 108.8 ± 6.8 %, respectively) (Figure 7). Reestablishment of total cover was more rapid following the 1986 winter burn than after the 1997 summer burn. In fact, by 60 months postburn the percent cover (> 0.5 m) in the stand recovering from the winter burn had exceeded the preburn cover.

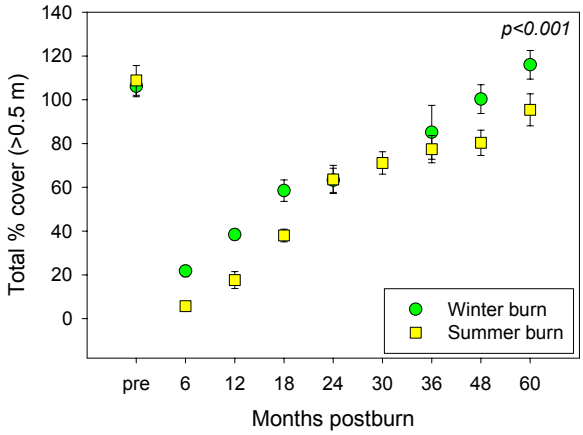

Figure 7: Total percent cover (> 0.5 m) for the recovery from the winter and summer burns. Data are means and error bars are standard error.

The percent cover of the two dominant species, *Quercus myrtifolia* and *Serenoa repens*, did not exhibit the same trend as the total cover (Figures 8 and 9). There was no significant difference in the recovery of *Quercus myrtifolia* following the winter and summer burns (ANCOVA; p = 0.961). Within 12 months of the winter burn, *Serenoa repens* returned to preburn cover. However, percent cover remained significantly lower after the summer burn than the winter burn until 18 months postburn.

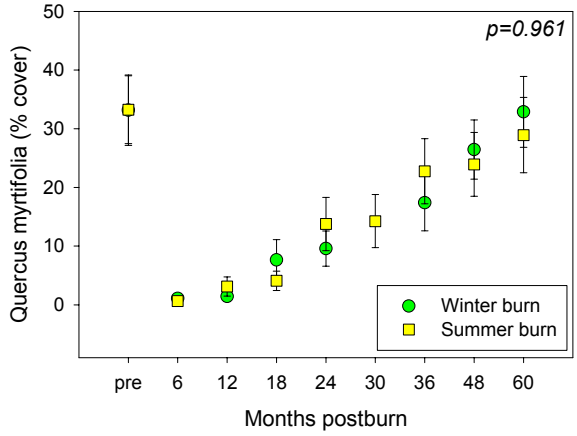

Figure 8: Percent cover of *Quercus myrtifolia* during the recovery from the winter and summer burns. Data are means and error bars are standard error.

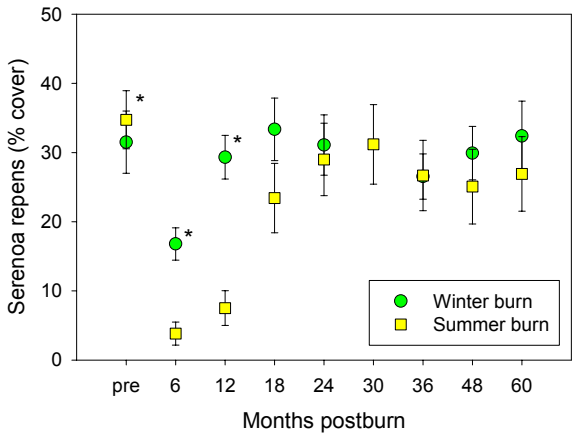

Figure 9: Percent cover of *Serenoa repens* during the recovery from the winter and summer burns. Data are means and error bars are standard error.

There was little to no bare ground in the stand preceding either the winter or summer burn (Figure 10). The percent bare ground was significantly greater six months after the summer burn than after the winter burn (39.6 ± 4.4 % and 22.9 ± 4.0 % respectively). However, by 12 months postburn no significant difference existed between the burns. The amount of bare ground rapidly declined, and by 36 months postburn little bare ground was present.

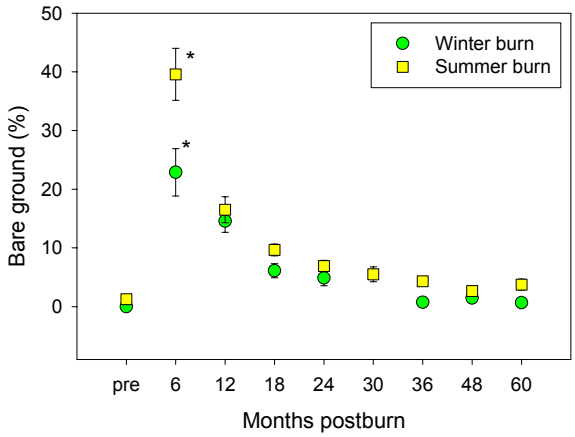

Figure 10: Bare ground (% cover) during the recovery from the winter and summer burns. Data are means and error bars are standard error.

5. DISCUSSION

Florida scrub, a fire maintained ecosystem, burned naturally during the summer months due to lightning ignition. However, due to difficulties in carrying out prescribed burns, current management practices at KSC/MINWR have been to burn year round. The effect of season of burn on height growth, percent cover, and percent bare ground is necessary for implementing a proper burn regime.

One goal of scrub management on KSC/MINWR is to provide habitat to support one of the three core populations of the Florida Scrub Jay (*Aphelocoma coerulescens*), a species Federally listed as threatened (Stith et al. 1996). Scrub-Jays are very habitat specific (Woolfenden and Fitzpatrick 1984) requiring periodically burned scrub, scrubby flatwoods, or flatwoods with patches of scrub oaks and some sandy openings (Breininger et al. 1998, 1999, Breininger and Oddy 2001). Optimal vegetation height for Scrub-Jay habitat is 1.2-1.7 m (Breininger and Carter 2003). Practices that increase or decrease the height growth of scrub might have implications for habitat restoration. However, height growth following the winter burn did not differ from the growth that followed the summer burn (Figure 2).

Although composition of the major and minor species was similar at 60 months postburn, with the exception of *Lyonia lucida* and *Aristida stricta* (Figures 5 and 6), the winter burn had a more rapid increase in the total percent cover (> 0.5 m) when compared to the summer burn (Figure 7). This difference was not noted in the dominant oak species, *Quercus myrtifolia* (Figure 8). Nor was this difference found in *Serenoa repens*, which reestablishes more quickly than the dominant shrubs (Figure 9). The recovery of *Serenoa repens* is important because it is the most flammable component of the Florida scrub, and significant loss of this species has implications for future burns. After the winter burn, the cover of *Serenoa repens* returned to preburn cover within 12 months. However, percent cover of *Serenoa repens* following the summer burn was significantly lower than the winter burn until 18 months postburn by which time it had also returned to preburn cover. Feral pigs (*Sus scrofa*) were observed pulling fronds off recently burned *Serenoa* plants (summer burn only), perhaps attempting to get to the apical meristem. This suggests that the difference in *Serenoa repens* cover was not due to the season of burn, but more likely due to the disturbance of the invasive pigs.

Another important habitat component for the Scrub Jays are sandy openings, or the amount of bareground, in the scrub (Woolfenden and Fitzpatrick 1984, Breininger et al. 1998). One of the management challenges in scrub is having prescribed burning regimes that not only maintain an open landscape but have sufficient scrub patches at optimum height for jay use (Schmalzer 2003). Although there was an initial difference in the amount of bare ground, with the summer burn having more bare ground than the winter burn; this disappeared after 12 months (Figure 10). This initial difference in the amount of bare ground can largely be explained by the decrease in *Serenoa repens* due to the pig disturbance. However following both the

winter and summer burns, the amount of bare ground rapidly declined so that by 60 months postburn little to no bare ground remained.

In order to make informed management decisions, an understanding is needed of how different management techniques affect the system and its recovery. This study suggests that for management purposes burning during the winter months may not have significant biological impact on the reestablishment of Florida scrub. This is in contrast to Florida sandhills, in which season of fire has been shown to have an effect on species recovery. The overstory and understory woody species tend to be more vulnerable to damage during summer burns. The season of burn can have varied effects on the herbaceous vegetation, altering relative abundances and flowering (Robbins and Myers 1992).

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