# 1C.6 RESPONSES OF LONG-UNBURNED SCRUB ON THE MERRITT ISLAND/CAPE CANAVERAL BARRIER ISLAND COMPLEX TO CUTTING AND BURNING

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## 1. ABSTRACT*

Restoration of long-unburned scrub on the Merritt Island/Cape Canaveral barrier island complex has been underway since 1992. Florida scrub ecosystems are shrublands maintained by relatively frequent fire. With fire suppression and landscape fragmentation, some scrub has reached a size structure resistant to fire under typical prescribed burning conditions. Without burning, the habitat suitability of scrub for a variety of species declines. We obtained pretreatment data from 186 permanent 15 m line-intercept transects in 29 stands across the barrier island complex. On acid soils (e.g., Paola, Pomello, Astatula, Orsino, and Immokalee series) (11 stands) oak-saw palmetto scrub occurred with *Quercus myrtifolia, Q. geminata, Q. chapmanii, Serenoa repens*, and *Lyonia ferruginea* as the dominant species. On less acid to circumneutral soils, (Cocoa, Welaka series) oak-saw palmetto scrub (6 stands) occurred although with ericads less abundant. On younger, alkaline soils (Canaveral, Palm Beach series), community composition changed to coastal scrub (12 stands) with a shrub form of *Quercus virginiana* as the dominant oak and *Q. geminata,* Q. *chapmanii*, and ericads absent. *Quercus myrtifolia* occurred in transitional areas, but *Serenoa* remained abundant. *Myrcianthes fragrans* and *Persea borbonia* increased in abundance in coastal areas. Mean height of unburned stands ranged from 1.5 – 7.5 m; height differences reflected different periods of fire suppression and probably different growing conditions. Mechanical treatments have included rotary cutters (Brown, Hydroax), K-G and V blades, tree-topper, and roller-chopper. Sites were prescribed burned after cutting. Fires were most effective if conducted within ca. 6 months of cutting. We obtained post-burn data on 147 transects in 23 stands by sampling at least annually. Regeneration on all sites was primarily by sprouting of woody species. Increases in weedy herbaceous species were small and transitory. In oak-saw palmetto scrub, recovery of oaks and ericads was similar in cut/burned stands to scrub burned without cutting. Saw palmetto cover was reduced by all mechanical treatments compared to burning only and that reduction persisted. Height growth in cut/burned scrub often exceeded growth of scrub burned without cutting. The dominant species in coastal scrub also sprouted after cutting and burning. Height growth of *Q. virginina* usually exceeded growth rates of other oaks. Invasion by the exotic Brazilian pepper (*Schinus terebinthifolius*) occurred in some coastal scrub on alkaline soils. Combinations of mechanical treatment and prescribed burning can be effective in restoring long-unburned scrub. Mechanical treatment must be used with care to avoid soil disturbance and excessive loss of saw palmetto, the most flammable component of the system.

## 2. INTRODUCTION

Florida scrub is a shrubland dominated by several species of clonal oaks (primarily *Quercus myrtifolia*, *Q. geminata*, *Q. chapmanii*), repent palms (*Serenoa repens),* and ericads (e.g., *Lyonia ferruginea*) that occurs on moderate to well drained, sandy soils low in nutrients. Scrub was maintained historically by intense fire. Post-fire recovery is primarily by sprouting of oaks, saw palmetto (*Serenoa repens*), and other shrubs. Composition and structure of scrub vegetation returns to preburn conditions rapidly (Abrahamson 1984a, b; Schmalzer and Hinkle 1992a, Schmalzer 2003). Scrub that remains unburned for an extended period declines in habitat value for the Florida Scrub-Jay (*Aphelocoma coerulescens*) (Breininger and Carter 2003), a species listed as threatened, as well as for other species. With time, scrub oaks can reach size and structure that make reintroduction of fire difficult or unsuccessful (Schmalzer et al. 1994). Scrub is typically a community of acid soils (Myers 1990, Menges 1999), but the situation on the Merritt Island-Cape Canaveral barrier island complex differs. Cape Canaveral is a recent barrier island (ca. 5000 years) where many soils are neutral to alkaline with shell fragments common in the surface horizon (Huckle et al. 1974). However, the predominant vegetation of Cape Canaveral is scrub, and historically the landscape burned frequently (Duncan et al. 2003, Duncan and Schmalzer 2003). Kurz (1942) recognized the unique character of scrub on Cape Canaveral, but little quantitative data have been available (Schmalzer et al. 1999).

Merritt Island is older, and most scrub occurs on acid soils, but some scrub is underlain by coquina, and those soils are less acid (Schmalzer et al. 2001).

Nearly all of Cape Canaveral has been within Cape Canaveral Air Force Station (CCAFS) since 1950, and

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fires were suppressed from 1950 to 1991. The northern two-thirds of Merritt Island has been within Kennedy Space Center-Merritt Island National Wildlife Refuge (KSC/MINWR) since 1961. Fires were suppressed from 1961-1981, but prescribed burning has been common on KSC/MINWR since then.

Restoration of long-unburned scrub has been a priority in recent years due to its importance for species of conservation concern. The approach to scrub restoration has been to use mechanical treatment followed by prescribed burning (Schmalzer et al. 1994, Schmalzer and Adrian 2001).

## 3. METHODS

We obtained pretreatment vegetation data from 186 permanent 15 m line-intercept transects located in 29 stands on Merritt Island and Cape Canaveral between 1992 and 2001. We recorded cover by species in >0.5 m and <0.5 m height strata. These data are summarized as percent cover; only the >0.5 m data are presented here. We measured height at 4 points (0, 5, 10, 15 m) along each transect. Location of each sample transect was recorded by a differentially corrected geographic positioning system (GPS).

Mechanical treatments have included rotary cutters (Brown, Hydroax), K-G and V blades, tree-topper, and roller-chopper. Sites were prescribed burned after cutting, in most cases within ca. 6 months of cutting. We obtained post-burn data on 147 transects in 23 stands by sampling at least annually for up to 10 years post-burn.

With the pretreatment data we conducted hierarchical cluster analysis (Ward's method, relative Euclidean distance) and ordination using detrended correspondence analysis (DCA)(PC-ORD version 4, McCune and Mefford 1999) at the stand level (N=29) using the mean percent cover of the stands. We included 43 species with mean percent cover >1.0%. We conducted similar analyses of the original transect data (N=186). We included in this analysis 40 species (out of 53) that occurred in at least two transects.

We compared height growth and recovery of dominant species after restoration treatments in oak-saw palmetto and coastal scrub to oak-saw palmetto scrub that has burned regularly (Schmalzer 2003). No time sequence of recovery after fire is available for coastal scrub. For oak-saw palmetto scrub, representative data are presented. Summary of all the available data for this type is beyond the scope of this paper.

## 4. RESULTS

All stands (10) on acid soil were dominated by typical scrub oaks (*Q. chapmanii, Q. geminata, Q. myrtifolia*), saw palmetto, and ericads, i.e., oak-saw palmetto scrub. Seven of eight stands on less acid to neutral soils were also oak-saw palmetto scrub. All stands (11) on alkaline soils were dominated by live oak, *Q. virginiana,* and saw palmetto, i.e., coastal scrub, as was one stand on neutral soil. Species associated with coastal strand (e.g., *Myrcianthes fragrans, Rapanea punctata*) occurred in some coastal scrub.

At the stand level oak-saw palmetto scrub and coastal scrub were differentiated clearly in both DCA ordination (Fig. 1) and in cluster analysis (not shown). The first axis of the DCA stand ordination is correlated (Spearman) to pH of the 0-15 cm layer (r=0.46, p=0.03). The second axis is correlated to pH of the 0-15 cm layer (r=0.72, p<0.001) and pH of the 15-30 cm layer (r=0.57, p=0.006). Ordination and cluster analysis at the transect level showed the same patterns (not shown).

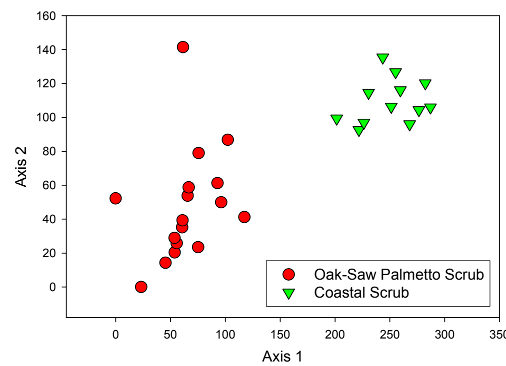


Fig 1. DCA ordination of 29 scrub stands.

Height growth of cut and burned oak-saw palmetto scrub (previously long unburned) equaled or more often exceeded that of regularly burned scrub (Fig. 2) (Schmalzer and Adrian 2001). Cut and burned coastal scrub also displayed rapid height growth relative to regularly burned oak-saw palmetto scrub (Fig. 3).

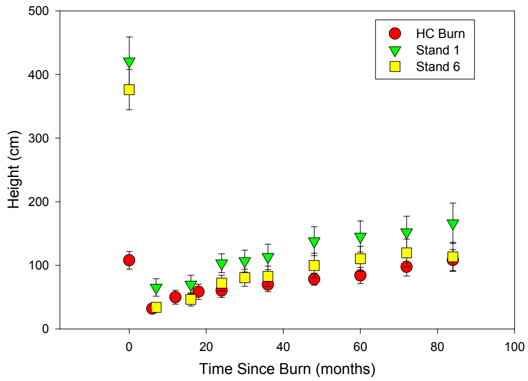


Fig. 2. Height growth in two stands of cut and burned oak-saw palmetto scrub compared to a regularly burned stand. Data are means and 95% confidence intervals.

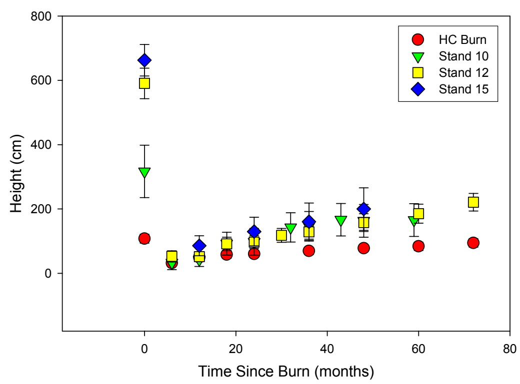


Fig. 3. Height growth in three stands of cut and burned coastal scrub compared to regularly burned oak-saw palmetto scrub. Data are means and 95% confidence intervals.

Saw palmetto is a dominant species in both scrub types. With fire but no mechanical treatment, saw palmetto cover returned to preburn values rapidly (Fig. 4). Mechanical treatments in oak-saw palmetto scrub (Fig. 4) and coastal scrub (Fig. 5) reduced cover of saw palmetto.

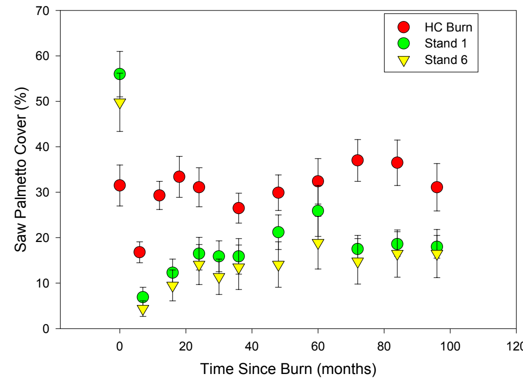


Fig. 4. Recovery of saw palmetto (>0.5 m) in two stands of cut and burned oak-saw palmetto scrub compared to a regularly burned stand. Data are means and 95% confidence intervals.

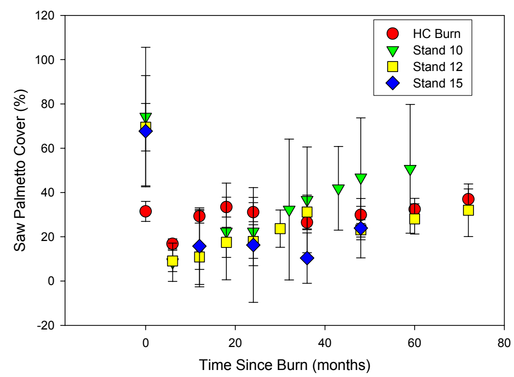


Fig. 5. Recovery of saw palmetto (>0.5 m) in three stands of cut and burned coastal scrub compared to regularly burned oak-saw palmetto scrub. Data are means and 95% confidence intervals.

Cover of dominant oaks (>0.5 m) in burned oak-saw palmetto scrub returned to preburn values within 5 years postburn (Fig. 6). Some long unburned stands of oak-saw palmetto scrub had high values of oak cover probably due to overlapping canopies of the oaks. There was substantial recovery of oak cover within 5 years postburn (Fig. 7) but not to preburn values. Live oak (*Quercus virginiana*) reestablished cover within 5 years postburn (Fig. 8).

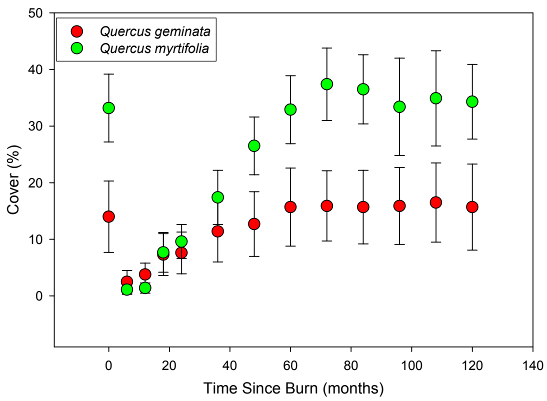


Fig. 6. Cover of dominant oaks (>0.5 m) after fire in a regularly burned stand of oak-saw palmetto scrub.

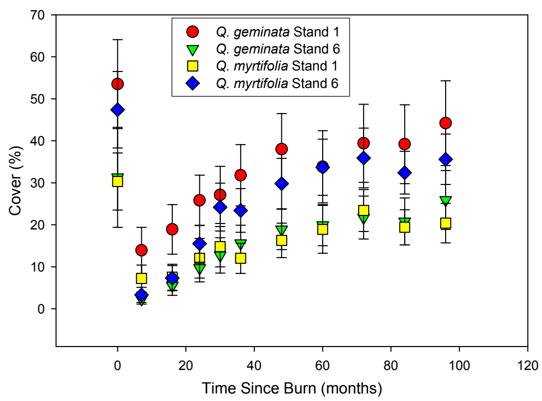


Fig. 7. Cover of dominant oaks (>0.5 m) after cutting and burning in two long unburned stands of oak-saw palmetto scrub.

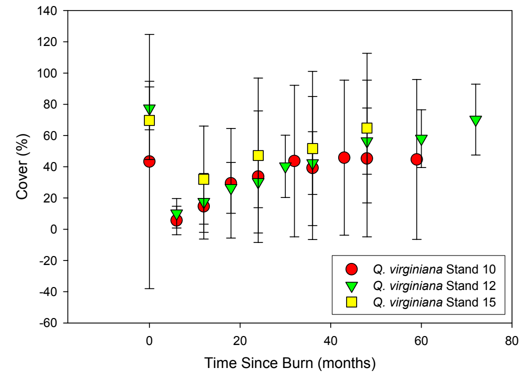


Fig. 8. Cover of live oak (>0.5 m) after cutting and burning in three long unburned stands of coastal scrub.

## 5. DISCUSSION

Our study shows using quantitative data that differences exist between scrub on the recent, relatively alkaline soils of Cape Canaveral and scrub on older acid soils. Coastal scrub has a different dominant oak, lacks ericaceous shrubs, and contains some species found in coastal strand. Such differences were noted by early studies (Kurz 1942). With decades of fire suppression, oak-saw palmetto and coastal scrub both reach heights much greater than regularly burned scrub. Such conditions are outside the habitat preferences of Florida Scrub-Jays (e.g., Breininger and Carter 2003) and other shrubland species. Both types of scrub can become fire resistant as the oaks become large, at least to most fires within acceptable limits for prescribed burning in these landscapes.

Both of these scrub types respond to fire primarily by sprouting of the dominant shrubs. This is well documented for oak-saw palmetto scrub and scrubby flatwoods (e.g., Abrahamson et al. 1984a,b, Schmalzer 2003). Fewer data exist for coastal scrub and strand (Simon 1986, Schmalzer and Foster unpublished), but the dominant species here also sprout after fire and reestablish cover rapidly.

Responses to restoration treatments of mechanical treatment and prescribed burning are broadly similar. Reestablishment of cover of dominant oaks and other woody shrubs is rapid. Oaks (and other shrubs) sprout from belowground roots and rhizomes. These structures are generally protected from fire and from equipment.

Height growth is as or more rapid in cut and burned stands of oak-saw palmetto than in regularly burned scrub. Release of nutrients from biomass and litter that accumulated over years of fire suppression may contribute to this rapid growth. Height increases more quickly in coastal scrub than in regularly burned oak-saw palmetto scrub, and growth rates may be more rapid than in cut and burned oak-saw palmetto scrub. Whether differences between growth rates of coastal scrub and oak-saw palmetto scrub reflect species or site differences is not known.

Saw palmetto reestablishes cover within one year after burning, but mechanical treatments reduce saw palmetto cover in both scrub types. The apical meristem of saw palmetto is above ground. It is protected from fire by leaf bases and the rhizome structure, but is vulnerable to damage from equipment. Saw palmetto rhizomes may sprout epicormically but grow less vigorously when they do so. Saw palmetto grows slowly (Abrahamson 1995) and reproduces slowly (Abrahamson 1999). It is the most flammable component of oak-saw palmetto scrub, and excessive loss of saw palmetto will degrade the ability of the system to burn again. Given the importance of saw palmetto to scrub and its fire maintenance, care should be taken to limit its loss. Rotary cutters, blades, and roller choppers all cause some loss of saw palmetto cover, and there does not appear to be systematic differences between equipment types. This loss can be moderated by careful application of treatment.

Coastal scrub on alkaline soil does appear more vulnerable to invasion by the exotic Brazilian pepper (*Schinus terebinthifolius*) than scrub on acid soil (unpublished data), particularly with soil disturbance.

Combinations of mechanical treatment and prescribed burning have been successful in restoring long-unburned scrub vegetation to a habitat structure of greater suitability for scrub-dependent species. All mechanical treatments result in some loss of saw palmetto cover, and that loss persists. Mechanical treatment should be used once to return to a vegetation structure that is then managed by prescribed burning. Rapid growth rates suggest that prescribed burning will need to be more frequent than often suggested in these systems to maintain desired habitat conditions, at least during a restoration period. The length of this restoration period remains to be determined.

## 6. ACKNOWLEDGMENTS

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