

Coastal Scrub Restoration: A Case Study for the Urban Interface

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ABSTRACT

Selective development pressures and fire suppression have resulted in a major decline in coastal scrub habitat and the Florida scrub-jay (*Aphelocoma coerulescens*) populations in Southwest Florida. Lemon Bay Preserve, a county-owned parcel adjacent to the Intracoastal Waterway in Sarasota County, was used as a case study for restoring scrub-jay habitat. The restoration was to compensate for various infrastructure impacts. The Preserve contains distinct areas of scrubby flatwoods and spoil material from intracoastal waterway dredging operations. As a result of years of fire suppression, timbering, and road construction, the scrub jay habitats were left in an overgrown state until the site was recently restored. Scrub-jay surveys on the Preserve and the surrounding residential areas revealed that jays were only using the periphery of the restoration site. The jay groups encountered primarily exhibited behavior and territorial boundaries typical of urban jays, and they largely relied on undeveloped single-home lots and hand-outs for subsistence. Methods employed for restoring the site to natural scrubby flatwoods conditions were selected with the primary goal of attracting neighboring groups of jays. Mechanical canopy thinning, mechanical fuel reduction, root-raking of bare sand areas, and limited fire applications were employed in this urban interface setting. The land management goals for this coastal scrub restoration project were to reduce canopy coverage, decrease understory height, increase bare sand patches, and maintain desirable oak coverage. Overall the restoration areas met these vegetative criteria. Although scrub-jays have not nested in the Preserve, preliminary results indicate that they are now utilizing the site more extensively than before the restoration.

INTRODUCTION

The Florida Scrub-jay (*Aphelocoma coerulescens*) is listed as a Threatened Species by both Florida Fish and Wildlife Conservation Commission and the U.S. Fish and Wildlife Service. Florida scrub-jay populations have been steadily declining throughout the State of Florida since the state's rapid development. Only approximately 20% of the pre-settlement populations existed in 1993 (Woolfenden and Fitzpatrick 1996), and these declines have continued in the last decade because of habitat loss, habitat fragmentation, and habitat degradation. Coastal scrub restoration projects are critical if this species is to persist in Southwest Florida. There is a tremendous amount of data and literature that support restoration recommendations for the central part of the State (Highlands Ridge) in a habitat typically called "true scrub." Significantly less information is known about Florida scrub-jay biology and habitat criteria in coastal scrub or scrubby flatwoods in Southwest Florida.

Sarasota County Government purchased the Lemon Bay Preserve, a mosaic of habitats with a predominance of scrubby flatwoods, to offset impacts to Florida scrub-jay habitat resulting from County Public Works projects. The property was in an extremely overgrown condition due to fire suppression and historical drainage of the area. Jays were observed in the adjacent residential areas where most experts agree local extinction was inevitable if proactive action were not taken to acquire and restore remaining habitat.

While most of the area surrounding the restoration site was occupied by suburban jays, remaining undeveloped areas of potential habitat were overgrown and discontinuous. Suburban populations are crucial repositories for dispersal of future generations into natural habitats (Thaxton and Hingten, 1996), however, habitat restoration and management are necessary to support successful reproduction. For example, while adult jays may exist for years in suburban environments, fledgling mortality is higher than that of jays in natural habitats (Toland, 1991; Woolfenden and Fitzpatrick, 1996). Restoration of overgrown habitat within the Preserve is expected to bolster the viability of local scrub-jay populations.

Restoration objectives, primarily set for scrub found in interior Florida, were tested on this coastal scrub habitat, typically considered an intermediate between scrub and pine flatwoods. The restoration team focused on obtaining a plant community that consisted of the following habitat criteria initially established by Cox (1987): 1) understory height of 1 to 3 m; 2) oak cover of 50 to 75%; 3) bare sand patches that comprised 10 to 30%; and 4) tree canopy cover of 15 to 20%. The report evaluates the land management methodologies selected to meet these habitat objectives in this urban interface with the overall goal of establishing jays in area where they were formerly extirpated.

STUDY SITE

The Lemon Bay Preserve, purchased in 1998 by Sarasota County Government, is located in the northern part of Lemon Bay in South Venice (Figure 1). The Preserve is located in Sections 4, 5, and 9, Township 40 South, Range 19 East, Sarasota County, Florida. The Preserve is 165 acres with approximately 90 acres of restorable scrub-jay habitat. Of this, a total of 75 acres of scrub-jay habitat are currently being managed as compensation for public works projects with unavoidable impacts. Management of the area is particularly challenging because the Preserve borders approximately thirty residential home sites within a larger community of 8,000 households.

The size of the property, quality and diversity of habitat, and proximity to known scrub-jay populations were significant factors affecting the selection of the restoration site. The Preserve is centrally located within the “Venice Suburbs Population” defined by Christman (2000) during his scrub jay distribution and habitat analysis study in Sarasota County, Florida. This population, one of 18 defined populations within Sarasota County, is a subgroup of the Florida scrub-jay metapopulation M5 described by Stith (1999), and accounts for 181 individuals in 76 groups (Christman 2000). Existing areas of high quality habitat present on the Preserve were found to support other State and Federally listed species.

METHODS

Land Management Activities

Land Management prescriptions were written after pre-development aerials of 1942 were compared to the pre-restoration aerials of 1998 (Figure 2). Although the landscape in this part of Venice was likely altered prior to 1942 due to its proximity to early logging operations in the 1920s, the presence of older trees with turpentine scars still evident today indicates these activities had a minimal impact on the scrubby flatwoods. Consequently, the 1942 aerial provided an excellent restoration target.

The management priority for the Preserve involved re-establishment of healthy habitat for scrub-jays in an area deemed as the wildland-urban interface. Due to the proximity of extremely high fuel loads to a high-density residential development, fire was not initially used. Safer mechanical means were used to reduce fuel loads and minimize risks to neighborhoods and meet the desired restoration objectives. According to Breininger et al (1999), “When restoring tall scrub back to optimal scrub, it is important to conduct those restoration activities (mechanical treatments and burning) throughout the majority of the scrub site when possible. Leaving a large area of tall scrub adjacent to a restored area reduces the survival of the Florida scrub-jay.” To meet this intent, a combination of exotic plant removal, tree density reduction, understory roller-chopping, bare sand patch habitat creation, and prescribed fire was used to restore the habitat and remove all dispersal and other behavioral barriers to scrub-jays. Land Management prescriptions for the different zones are summarized in Figure 3.

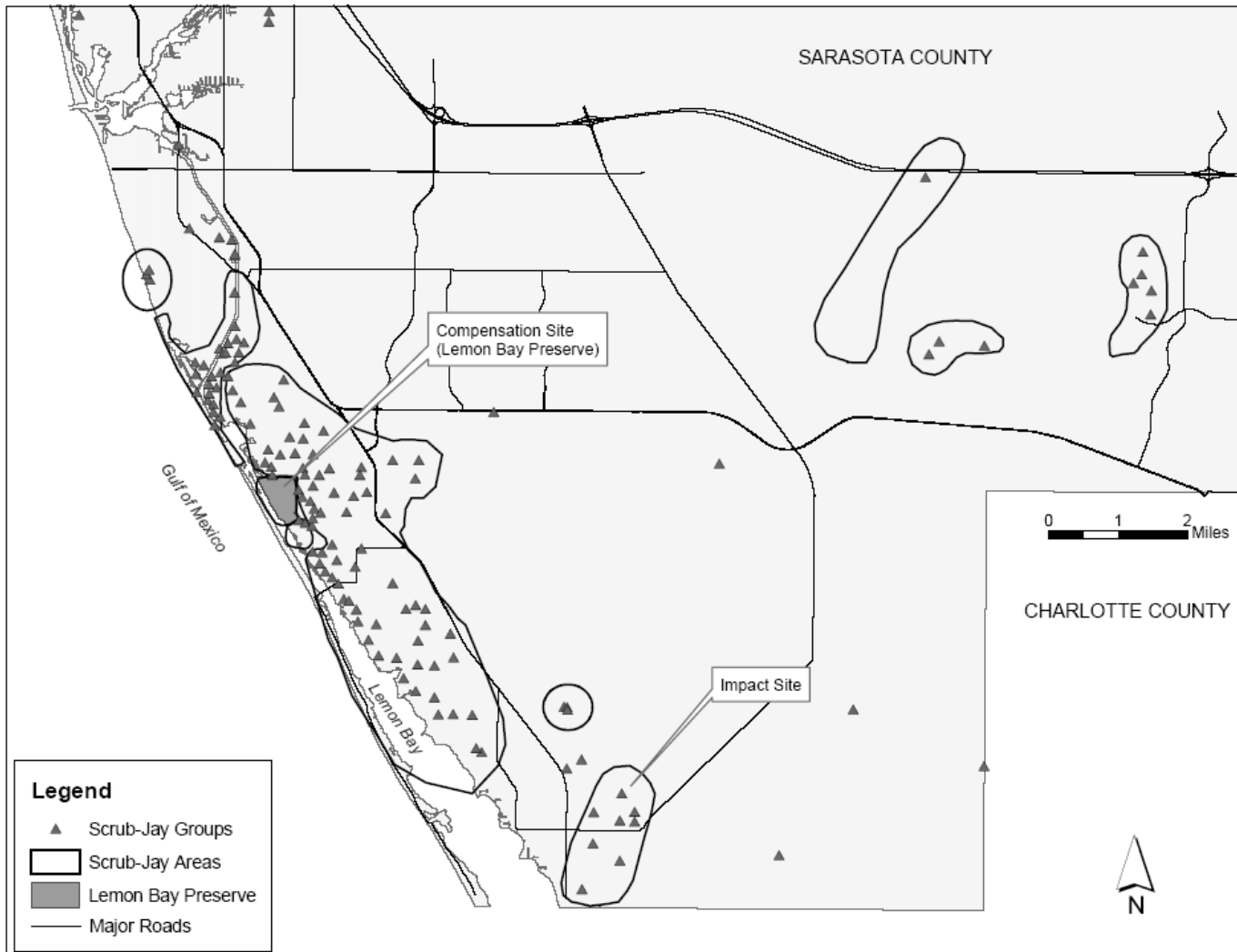


Figure 1. Lemon Bay Preserve Compensation Site location and Scrub-Jay distribution in south Sarasota County. Scrub-Jay areas indicate approximate population polygons estimated by Christman (2000).



1942



1998

Figure 2. Historic and Pre-Restoration comparison of Lemon Bay Preserve area, demonstrating landscape and plant community changes following Intracoastal dredging, mosquito-ditching, fire suppression, and extensive colonization of disturbed areas by exotic species.

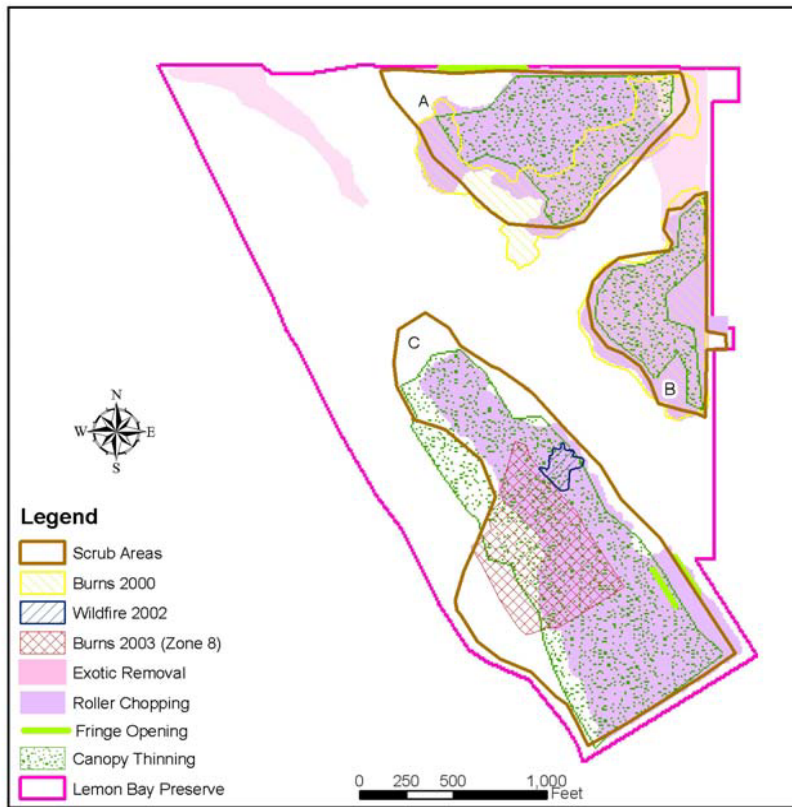


Figure 3. Overview of Coastal Scrub Restoration site treatment locations, size, and date.

Zone	Treatment	Area (ac)/ Length (ft)	Date
A	Exotic Removal	2.09 ac	1999
	Roller Chopping	17 ac	July 2000
	Canopy Thinning	12.94 ac	June 2002
	Prescribed Fire	11.72 ac	Sept 2000
	Fringe Opening	456 ft	June 2002
B	Exotic Removal	1.09 ac	1999
	Roller Chopping	11 ac	July 2000
	Canopy Thinning	6.46 ac	June 2002
	Prescribed Fire	11.83 ac	Sept 2000
C	Roller Chopping	27.1 ac	July 2000
	Canopy Thinning	32.22 ac	June 2002
	Lightning Fire	0.7 ac	June 2002
	Prescribed Fire	9.76 ac	July 2003
	Fringe Opening	470 ft	June 2002

Before restoration, Brazilian pepper (*Schinus terebinthifolius*) provided a significant barrier to scrub jay movement to and from Zones A, B, and C on the Preserve and sub-optimal habitat areas in off-site residential areas. These physical barriers usually existed in many of the transitional areas between wetlands and scrubby flatwoods on the site. In 1999, pepper trees were mulched in place with a specialized Brown's Tree Cutter, usually leaving a thick mulch layer. Later in 2003, additional pepper trees and oak trees were removed from an additional "Fringe Opening".

As a result of over 60 years of fire suppression, native upland plants (trees and shrubs) also provided a significant barrier to jay use. The reduction of the understory and canopy were accomplished by three main means. The height of understory vegetation was reduced through a combination of techniques. Zones A and C were accomplished through a roller-chopping and hand removal. Hand removal consisted of large field crews with hand chainsaws and mulching equipment with the ability to handle as great as a 16-inch diameter tree. In addition, a rear-feed, 12-inch chipper was used instead of a large tub grinder because the chipper was much more maneuverable and could be placed immediately adjacent to vegetation clearing piles. Roller-chopping was the main technique used in Zone B because fewer larger trees provided obstacles for the tractor to maneuver and reduce down time. Most of the roller-chopping was done in July 2000. A 10-ft wide, double drum spiral-toothed chopper pulled by a D6 high track bulldozer was driven several times over each area in order to reduce the vegetation. In order to minimize soil disturbance and limit impacts to gopher tortoises (*Gopherus polyphemus*), the drums were not filled (Powers 2001). Brush-hogging in select areas in Zones A and C was done in 2003.

The second assignment was to reduce the density of trees by removing 85% of the existing trees. Restoration specialists and scrub-jay experts selected and marked predominantly pines (*Pinus elliotti*) and oak trees (*Quercus* spp.) that were to remain as part of the canopy thinning operation. The selection process included leaving larger, older and smaller, younger trees to produce a healthy uneven-aged forest with trees from various age classes. The majority of the trees removed were less than 24 inch DBH. Selective tree-harvesting equipment consisted of a feller buncher, a log skidder, a trailer-mounted loader, large and hydraulic chain saw. Off-road semi tractors were used to haul logs out to the paved road for pickup. Heavy equipment operators were directed to stay in designated areas to protect gopher tortoises and other wildlife including commensal species and to minimize impacts to tortoise burrows and desirable vegetation recovering from initial rollerchopping efforts. Harvestable trees were cut separately at the base and carried to small loading areas where they were picked up by the log skidder. Limbs and other unmarketable material were mulched and removed from the site. Marketable pine trees were only taken from Zone C. Mulch from unmarketable pine and oak trees was provided to the public for private landscaping needs, thereby saving the costs associated with trucking and dump fees.

In addition to reducing tree and shrub density, the restoration plan also called for a number of areas with no vegetation. Scrub jays use sandy patches with little to no vegetation for caching of acorns and to patrol nests and territories from ground predators, such as snakes. Selected linear corridors of vegetation were cleared, and bare sandy patches were created in several

locations throughout the project site. Existing trails were used when possible. Bare sandy corridors totaled approximately 10,335 linear ft and were a maximum width of 25 ft along the urban interface and 20 feet in the interior of the project. Bare sandy patches, which varied in size, totaled approximately 3.7 acres throughout Zones A, B, and C. To strip the area of shrubs and prevent further re-establishment of resprouting vegetation, a front-end loader with a root rake was utilized. The material generated from clearing activities, which was comprised of mostly saw palmetto and small oak trees, was moved and stockpiled in a few strategically located areas again to minimize unintended impacts to habitat and wildlife.

Prescribed fire was conducted on a number of occasions with limited success. Small areas in Zones A and B were burnt in 2000 following roller-chopping. Lightning has struck three pine trees on separate occasions since Spring 2002. One lightning strike resulted in a small wildlife (under 3 acres) that extinguished naturally. In 2003, a prescribed burn was conducted in Zone C.

Vegetation Monitoring

Vegetation was monitored qualitatively to determine oak coverage and recovery rate following land management activities. Additionally, canopy coverage was visually estimated on-site and with the aid of aerial photography. Xeric scrub oak height and density was also assessed visually at permanent photo stations with PVC staff gauges marked in 1-ft increments.

For comparison of root raking and prescribed burning to re-establish bare sand patches, herbaceous/ground cover was assessed in 10 m² plots by visual estimates. Percent cover was estimated independently, allowing for overlap of interspersed layers, such as *Vitis* sp. and natal grass (*Rhynchelytrum repens*) growing over spikerush (*Eleocharis* spp.) Three root-raked plots and two burned plots were compared.

Scrub Jay Monitoring

Fall and Spring scrub-jay surveys have been conducted since 1999. Survey techniques follow the techniques outlined in Fitzpatrick, Woolfenden, Kopeny (1991). Three transects were established within the Preserve boundaries in 2000. At the recommendation of the Florida Fish and Wildlife Conservation Commission, a fourth transect was established in 2001, along the Phorus Road parcel, located just southeast of the Lemon Bay Preserve. Five listening stations were added in 2002 in the surrounding suburban area to better identify local scrub-jay territories. A tape recording of the Florida scrub-jay territorial scolding was played for five minutes at each listening station. The tape was broadcast in all directions, emphasizing any direction in which low-growing scrub oak was the predominant vegetation. The number of scrub-jays observed, band color, behavior, perches and flight paths were documented. After the scrub jays were observed in an area, scrub-jay territories were determined through casual observation of jay behavior without enticing the birds with taped calls or food supplements.

RESULTS AND DISCUSSION

Vegetation

The vegetation responded quickly to the series of land management treatments administered. In 2003, Chapman's oak (*Quercus chapmanii*), myrtle oak (*Quercus myrtifolia*) and sand live oak (*Quercus geminata*) reached heights in excess of five feet and produced acorns. Oaks were the dominant plant in many of the restored areas, and met the restoration objective of 50 to 75% for the entire site. In some areas, especially in Zone C, saw palmetto (*Serenoa repens*) was the dominant cover. Restored areas have regrown quickly in the two to three years following roller-chopping or bushhogging and minor burning. Other dominant understory vegetation consisted of shiny blueberry (*Vaccinium myrsinites*), tarflower (*Befaria racemosa*), and sky-blue lupine (*Lupinus diffusus*).

While roller-chopping successfully reduced standing fuel loads and scrub heights, remaining organic debris formed deep humus layers in some areas, fostering exotic plant germination and limiting bare sand exposure, particularly in Zone B. Canopy thinning efforts reduced coverage in Zone A from greater than 25% to less than 10%. Zone B canopy cover was reduced from 20% to 15%, and Zone C canopy cover was reduced from greater than 30% to between 10% and 20%. Figure 4 shows successive photos from a photostation in Zone B, documenting the dramatic change in biomass structure associated with restoration treatments. Re-growth of scrubby oak species was rapid following rollerchopping, with oak cover ranging from 40 to 70%. This successful fuel load and scrub height reduction and change in canopy cover conform to Cox's (1987) recommendations with regard to understory height of 1 to 3 m, oak cover of 50% to 75%, and tree canopy cover of 15% to 20%. Similar success was demonstrated in Zones A and C.

The remaining criterion set forth by Cox for optimal scrub was the presence of bare sand patches. Roller-chopping yielded limited results because of the organic debris described above. Root raking provided an effective means of exposing mineral soils and limiting scrub shrub regrowth, but was not as effective as burning. A comparison of sand-patch regeneration methods is presented in Figure 5. Species present following sand-patch restoration were identical for both methods; however, composition of the herbaceous layer varied between the two treatment types. The most obvious differences in herb layer composition between the treatment types are the amount of exposed soil and coverage of natal grass, and low panicums (*Dichanthelium* sp.). Burned patches had a much lower coverage of these species than root-raked patches and a greater area of exposed mineral soil following six months after treatment. Natal grass is a common invasive plant of dry and transitional areas in southwest Florida, and its prevalence in root-raked areas may be attributable to higher germination rates in moisture-retaining organic debris. Low panicums have been widely recognized as pioneer species in overgrazed areas or following soil disturbance and also prefer wet soil conditions of natural hydric pine flatwoods. It is also possible that the heat of the medium-intensity, medium-duration burn reduced seed germination rates for herbaceous species in this scrubby flatwoods habitat. Nevertheless, mechanical removal of vegetation including roller-chopping and root-raking are important tools for scrub restoration and maintenance in urban interface areas.

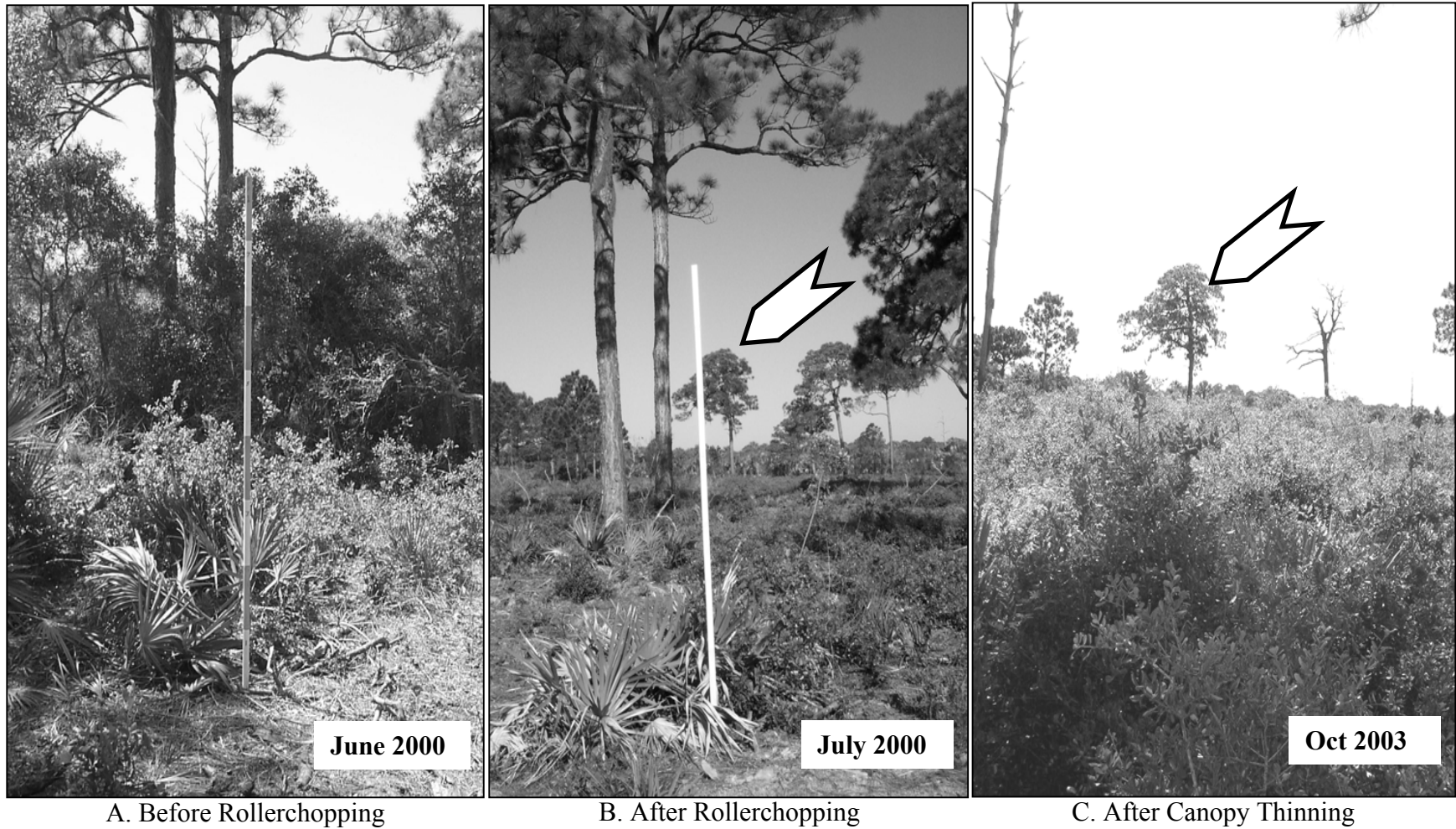


Figure 4. Coastal scrub restoration photographic sequence of canopy and ground cover changes in Zone C. Arrows indicate a slash pine (*Pinus elliottii*) for horizon reference following canopy thinning.



Root Raked Area



Burned Area

Average Cover Values for Herbaceous Layer Regrowth

Root Raked Area (N=3)	
Species	% Cover
<i>Rhynchelytrum repens</i> *	>50%
<i>Aristida</i> spp.	>30%
<i>Andropogon</i> spp.	>20%
<i>Eleocharis</i> sp.	<30%
<i>Dichanthelium</i> spp.	>75%
<i>Euthamia minor</i>	<5%
<i>Vitis</i> sp.	<20%
Bare	<5%

Burned Area (N=2)	
Species	% Cover
<i>Rhynchelytrum repens</i> *	<30%
<i>Aristida</i> spp.	<20%
<i>Andropogon</i> spp.	<10%
<i>Eleocharis</i> sp.	<5%
<i>Dichanthelium</i> spp.	<20%
<i>Euthamia minor</i>	0%
<i>Vitis</i> sp.	<5%
Bare	40%

* Exotic/Invasive species

Figure 5. Visual and quantitative comparison of sand-patch regeneration methods, mechanical root-raking vs. medium-intensity, medium-duration burn. Cover values were assigned independently in 10m² plots.

Scrub-Jay Activity

During the Fall 2003 surveys, a total of 10 to 12 scrub jays were observed either in the Lemon Bay Preserve or the neighboring properties to the north and east. Jays were observed caching acorns in the recently cleared habitat in three separate areas. This is consistent with findings from Oscar Scherer State Park, also in Sarasota County (Hingtgen and Thaxton 1999). During the Spring 2003 surveys, seven jays were observed in the same relative areas. The initial March 1996 survey confirmed the existence of the resident jay family at the edge of Zone B. Jays were more recently observed utilizing the habitat provided by the Preserve, as well as adjacent residential properties. Three jays identified included a breeding male, a helper, and an un-banded breeding female. These scrub-jays collected twigs and other building materials from the Preserve to build a nest located in a southern red cedar (*Juniperus silicola*) on a developed lot approximately 15 feet from the Preserve boundary. Later that year, three young fledglings were observed within the Preserve utilizing the cover provided by the restored scrub oak areas. All young appeared healthy. A comparison of pre-restoration scrub-jay use in 1996 with that of post-restoration period indicates significantly increased scrub-jay activity in Zone B and completely new activity in areas in Zones A and C (Figure 6).

CONCLUSION

The ultimate goal of returning the Florida scrub-jay to the scrubby flatwoods of the Lemon Bay Preserve has been partly realized. Scrub jay activity has increased significantly as a result of the restoration work that has occurred. The habitat restoration objectives, designed for an urban-wildland interface, were accomplished. Understory density, oak shrub height, and scrub oak dominance were all improved through a series of prescriptions that focused on mechanical land management techniques. These techniques, although partially effective, cannot completely mimic the effects of prescribe fire. Therefore, prescribe fire should follow mechanical land management whenever feasible. Exotic plant removal in transitional zones and tree removal in linear corridors helped to eliminate barriers to movement, dispersal, and other scrub-jay uses. Future land management activities will focus on further removing physical barriers for scrub-jays and burning the area to further promote bare sandy patches for acorn caching and as a predator deterrent. Future goals will focus on increased scrub-jay use of the Lemon Bay Preserve, including location of nests and maintained territories exclusively within the Preserve boundaries.

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Figure 6. Scrub-Jay utilization of restoration site, before and after restoration activities. Markers indicate documented presence during regular surveys.

financial and moral support during the restoration project. We would also like to thank some of the field supervisors and heavy equipment operators from Sarasota County Drainage Operations and the Sheriff's Department for thinking out of the box on the practical end of using heavy equipment in an environmentally sensitive area. We would also like to acknowledge the flexibility and assistance with restoration recommendations made by Jeff Weller and Chuck Schultz of the U.S. Fish and Wildlife Service, Jon Thaxton, a local scrub jay expert and County Commissioner, and Jim Beever of the Florida Fish and Wildlife Conservation Commission. We would also like to acknowledge Mike Barker and Jeff Weber of Sarasota County Natural Resources for their contributions in the early stage of the project. Last but not least, the project could not have been completed ahead of schedule and within the approved budget without the expertise of the County's resourceful contractor, E Co Consultants, Inc.

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