FLATWOODS RESTORATION ON THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT, FLORIDA: A PRESCRIPTION TO CUT AND BURN

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ABSTRACT

The St. Johns River Water Management District, hereafter "District," is one of 5 independent taxing districts charged by the State of Florida with the protection of water resources. Water resources are protected through regulation and through the purchase and management of lands adjacent to major waterbodies and groundwater recharge areas. In 1990 the District acquired 4,453 hectares near Lake George, Florida, from a corporate landowner. This was one of the first parcels acquired with significant uplands and timber potential. The previous landowner had successfully managed the property to maximize fiber production. Although the District will capitalize on timber revenues resulting from management of the land, the District's primary focus is preservation and restoration of the natural community. During the planning phase, the benefits and costs of 2 restoration options were considered: (1) to clear-cut the existing slash pines (*Pinus elliottii*) and replant with longleaf pine (*P. palustris*) to restore preplantation longleaf pine community or (2) to manage the existing plantations to achieve old-growth conditions more quickly. Because the restoration of old-growth conditions was considered the more urgent goal, the decision was made to manage the existing slash pines and convert existing stands to longleaf only when some natural disturbance, such as wildfires or insect outbreaks, provided the opportunity.

But what components of a natural flatwoods community could be restored to an even-aged plantation with limited species diversity, and how could the restoration be accomplished? Prior to acquisition, the understory had been subjected to heavy mechanical site preparation through chopping, raking, and, in some cases, bedding. This disturbance, coupled with an absence of burning, had resulted in a duotypic stand composed of dense slash pine plantations with an understory of 1.5–2-meter-tall saw palmettos (*Serenoa repens*). Little or no herbaceous vegetation existed. Dense shading of the forest floor, especially from the thick growth of saw palmetto, profoundly affected the diversity and extent of ground cover vegetation and greatly diminished habitat function and values. In 1992 a program of thinning and prescribed burning began. After noting a favorable response to early efforts, the District initiated a low-intensity monitoring effort. This monitoring, combined with casual observations of improved plant and animal species diversity, indicated that the prescription of cutting and burning can begin restoring more natural flatwoods community functions to the former plantations.

keywords: flatwoods, monitoring, prescribed burning, restoration.

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INTRODUCTION

The St. Johns River Water Management District purchases land for the purpose of protecting water quantity and quality. The District's legislative charge is "to manage and maintain land, water and related resources in an environmentally acceptable manner, and to the greatest extent practicable, to restore and protect their natural state and condition" (Florida Statutes 1998: Section 373.59). In fulfilling this charge, the District purchased 4,453 hectares of land along the eastern shore of Lake George, Florida, from a corporate landowner in 1990. An additional 3,240 hectares were purchased jointly with Volusia County, Florida, and are managed by the county. Together, these purchases protect almost 16 kilometers of undeveloped shoreline and >3,600 hectares of wetlands.

The Lake George purchase, now known as the Lake George Conservation Area, contained large areas of planted pine. To ensure compliance with the legislative charge, the District selected a consultant to develop a multiple use management plan. For the 2,348 hectares of flatwoods, the consultant offered the District 2 management alternatives. First, since most of the flatwoods had naturally supported longleaf (Hebb and Clewell 1976) and had been converted to slash pine plantations, we could clear-cut the slash and replant longleaf. Second, the District could manage the existing slash through selective harvesting and prescribed burning to initiate a slow restoration process. The even-aged, infrequently burned forest would gradually evolve into an uneven-aged community with a fire-return frequency of 3–5 years.

The second alternative was chosen for the following reasons:

1. The Lake George Conservation Area contained 8 active and 9 inactive bald eagle (*Haliaeetus leucocephalus*) nests. Most of the nests were found in remnant natural longleaf and slash pines that have been protected from harvesting by wet site conditions. Few trees suitable for nesting existed, and few old trees were available to replace them. Managing the existing stands would ensure the avail-

ability of older, large-canopied trees suitable for nests.
2. While the area of longleaf pine had been greatly reduced (Boyter 1993, Frost 1993, Outcalt and Sheffield 1996), stands of older-aged, 50–120-year-old pine flatwoods were even less available in the area. The existing slash pine offered the opportunity to attain an old-growth pine community sooner.
3. Other lands in District ownership were in more urgent need of planting because they had been clear-cut prior to purchase.

Although the decision was made to manage the existing slash pines, it was also decided that should an opportunity to replant arise (because of insects, disease, wind throw, or fire), longleaf would be the species of choice.

STUDY AREA

The Lake George Conservation Area suffers from moisture extremes, which is typical of flatwoods areas (Laessle 1942). Without precipitation, the site can go from inundated soils to drought conditions in 10 days. The average rainfall is 130 centimeters, more than half of which falls between June and September (Laessle 1942).

The previous landowner focused on management techniques that maximized fiber production. Mechanical site preparation, such as raking, chopping, bedding, and windrowing, was routinely performed to establish the plantation. These site preparation practices can have an immediate and harmful effect on the understory and herbaceous ground cover (Wood and Niles 1978, Boyter 1993, Outcalt and Sheffield 1996). If left unburned, these plantations can develop a dense shrubby understory that greatly reduces ground cover species diversity and significantly reduces wildlife habitat values.

Planted stands ranged in age from 2–31 years. Basal area within the merchantable stands ranged from 4.6–13.9 square meters and from 740–1,480 stems per hectare. There had been little or no fire management other than site preparation burning. The high pine density and lack of fire had led to the development of a duotypic condition (Wood and Niles 1978). Most stands consisted of a closed canopy of slash pine with a dense under- and midstory of 1.2–2.4-meter-tall saw palmettos. In this case, as has been observed elsewhere (Heyward 1939, Ober 1954, Sackett 1975, Wood and Niles 1978, Wade 1981, Lewis et al. 1982), flatwoods protected from fire soon undergo succession, to the detriment of most herbaceous vegetation. Little herbaceous vegetation was observed.

The herbaceous plant community was not alone in its disappearance. Although no specific wildlife surveys have been performed in the Lake George Conservation Area, District land management staff had noticed an absence of common species, including whitetail deer, turkey, and bobwhite quail. The reduced wildlife populations are possibly the result of poor habitat and excessive hunting during the previous ownership.

The following questions were considered during the initial restoration planning phase. Did the herbaceous vegetation disappear as a result of the mechanical disturbance or succession? Were there enough remnants of the herbaceous plant community left to reoccupy the site, or would planting be required?

METHODS

Restoration began with winter hazard reduction backing fires first targeting the oldest and most crowded stands, then moving on to the younger, less crowded stands. Fuel had accumulated to a highly hazardous level, and significant mortality would result from a fire under any but the most ideal conditions (Sackett 1975, Wade 1981, Outcalt and Sheffield 1996). Burning was the necessary first step because it protected the stand from wildfire (Sackett 1975) and allowed marking crew access. Initial burns were conducted in the winter to minimize risk to the overstory (Sackett 1975, Wade 1981).

Once fuels were reduced, trees were marked for thinning. The target basal area was 5.6 square meters per hectare. Every fifth row and suppressed trees within the remaining 4 rows were selected for harvest. Marked timber was then sold through sealed bid, lump sum sales.

Although we were aware of the risks of wind throw from harvesting >30% of the stand in 1 harvest, these risks were outweighed by the need to relieve crowding. In some cases, >50% of the basal area was removed in the initial thinning.

Casual observation following the first cycle of prescribed burns and harvesting began to find signs of a favorable response to the management technique. The postharvest pine stands exhibited good health and growth. The combination of burning and thinning opened up the understory and ground cover. The dense saw palmetto cover gave way to a mixed ground cover of shrubs, herbs, and grasses. The District decided to implement a monitoring program to record the changes in species diversity and structure over time. The goal of the monitoring is to provide guidance with land management decisions in similar community types.

Since the size of the District's land management staff is limited (20 people managing 141,700 hectares), we needed a monitoring system that was cheap, quick, and easy. Photographic monitoring was selected because it provided an efficient means to observe the trends in vegetative change within the study areas. Furthermore, it can be accomplished in a relatively short time period and with minimal demands on staff. This method provides a permanent record of physical changes in the vegetative community over time.

Nine photo-point stations were installed within the Lake George Conservation Area, 3 stations within each of 3 forest management units. The units were selected based on age and management activity. The stations were established by randomly selecting a point

on the interior access road within the management unit. From the selected points, a cardinal compass point was traversed for 40 meters. Metal signposts were installed as permanent reference points. Differential GPS data were collected for each photo-point station during the 1998 monitoring effort.

Since 1995, each photo-point station has been visited annually, in late January. Five photos are taken at each station: four at cardinal compass points and one at the permanent reference point.

The primary element of this monitoring program is to capture a photographic record of community response to management techniques; however, vegetative data are also collected near the permanent reference posts. Though not a rigorous sampling effort, it provides a record of changes in species composition.

To minimize the risk of pine mortality, operating guidelines called for ≤1 disturbance (harvest or fire) to occur in a stand per year. After harvest, a stand was allowed to rest for ≥1 growing season before a prescribed burn occurred. The season of the first burn following harvest was selected based upon fuel loading. If the logging and the preharvest burn had been successful in reducing the rough, sites would be burned during the growing season. If the rough had not been sufficiently reduced, sites would be burned during the dormant season.

RESULTS AND DISCUSSION

To date, 551 hectares have been selectively harvested, with a gross revenue of $711,190. All but 63 hectares of merchantable flatwoods have been burned at least once, and 275 hectares have received 2 burns. An additional 895 hectares of premerchantable timber have been burned once and are awaiting merchantability to be thinned.

Preliminary evaluation of the results of the vegetative observations suggests an increase in low-growing herbaceous species from 0.5 species per plot in 1995 to 2.15 in 1998 (Figure 1). Although the numbers of shrub species have increased slightly, from 3.125 to 3.625 species per plot, the photo plots demonstrate a reduction in shrub dominance. Saw palmetto height has been reduced to an average of ≤60 centimeters. This change is in response to the prescribed burning and mechanical disturbance resulting from thinning operations, which reduces the cover of saw palmetto and other woody species, thereby allowing more sunlight to reach the forest floor (Heyward 1939, Kirk et al. 1974, Wood and Niles 1978, Moore and Terry 1980). The species diversity and coverage is expected to respond positively to the continued use of the present management regime. If the prescribed fire program is not conscientiously applied, shrubs will again dominate the community and ground cover species will again decline.

Monitoring was undertaken to detect community changes that resulted from selected forest management techniques. These changes are projected over a long time period. An annual, midwinter data collection effort was thought to be sufficient to capture those changes, and has proven successful. Midwinter observation may introduce seasonal bias by not capturing some lesser herbaceous species that have a dormant season. Consideration will be given to implementing a semiannual monitoring effort to include growing-season observations.

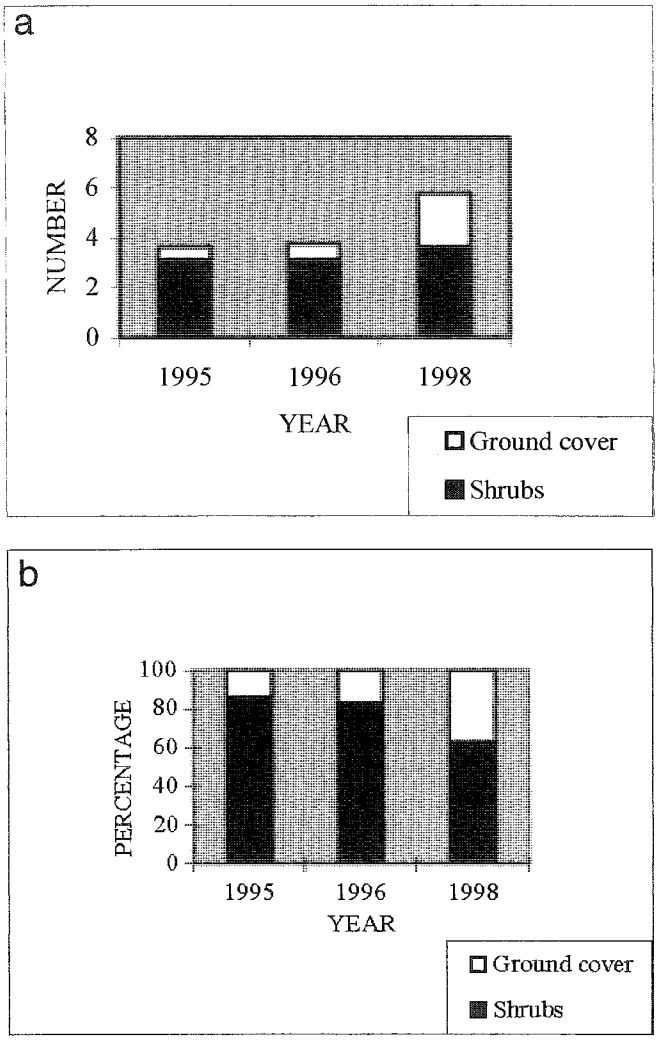

Fig. 1. Summary of annual observations showing an increase in the number of ground cover species (a) with corresponding increase in coverage (b).

When thinning, foresters historically have been concerned about damage to residual trees resulting from harvesting equipment and have encouraged loggers to be sensitive to the site. Following the harvest on the first site, we observed that the greater the mechanical disturbance from the equipment, the greater the abundance of herbaceous plants. This observation was consistent with the effect of chopping in reducing saw palmetto dominance (Kirk et al.1974, Moore and Terry 1980). Efforts were made to encourage harvesting equipment to run over as much of the surface as possible while protecting residual pine stems from damage and preventing the site from developing ruts during wet conditions.

We also observed that the disturbance created by

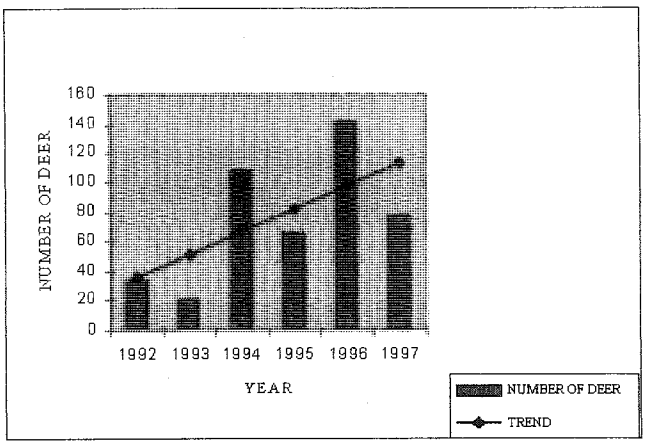

Fig. 2. Number of deer, 1992–1997, based on track count surveys (FGFWFC, unpublished data).

the logging equipment during the spring seems to have greater impact in reducing palmetto than similar activity at other times during the year. This observation is not fully understood, and we will continue to investigate.

Wildlife observations have increased, as has hunters' success (R. Horton, Florida Game and Fresh Water Fish Commission [FGFWFC], personal communication). Recent observations by land management staff also indicate an increased number of white-tail deer, turkey, black bear, gopher tortoise, and sandhill cranes. Some of the increase may be as much from improved visibility as from increased numbers. The population increases have yet to be confirmed by conducting a thorough wildlife survey. Track counts from deer, however, reflect a trend of overall increase that is not based upon increased visibility. Although the number of deer in the conservation area has fluctuated from year to year, the trend has been an increase—from 34 in 1992 to 77 in 1997 (Figure 2).

A prescribed burn program was implemented following the property's acquisition in 1990. With each burn, land management staff gained more local knowledge of community response to fire. Postburn assessments of the various burn units began to show the Keetch/Byram drought index (KBDI) as an important community response predictor. Fuel reduction was the primary objective of the initial burns. Most burn units had accumulated a thick layer of duff. Experience has shown that prescribed burns with the KBDI <250 would achieve desired fuel and duff reduction without harming the forest. Prescribed burns performed with a KBDI >250 were found to smolder for extended periods, resulting in root damage that caused direct mortality and secondary losses due to Ips beetles.

CONCLUSION

In 1989 the State of Florida recognized the need to protect the natural areas of the state through land acquisition. That year under a program called "Preservation 2000," the legislature approved annual funding of $30,000,000 until the year 2000 for purchasing natural areas. With the Preservation 2000 program increasing public lands and with an overall shift among land managers toward ecosystem management, restoration of disturbed sites is increasingly important. In some cases such restoration can be accomplished by simply reintroducing more natural conditions and processes even after years of their absence. At the Lake George Conservation Area, overstory thinning and prescribed fire have been used as tools in slash pine plantations to begin restoring elements of the natural community.

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