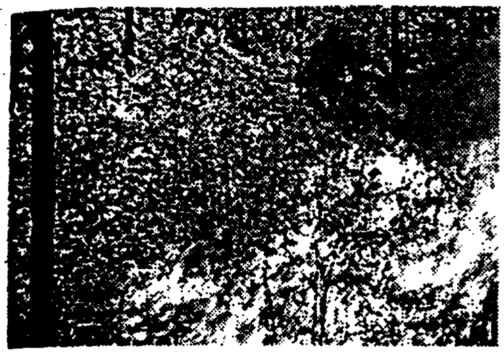
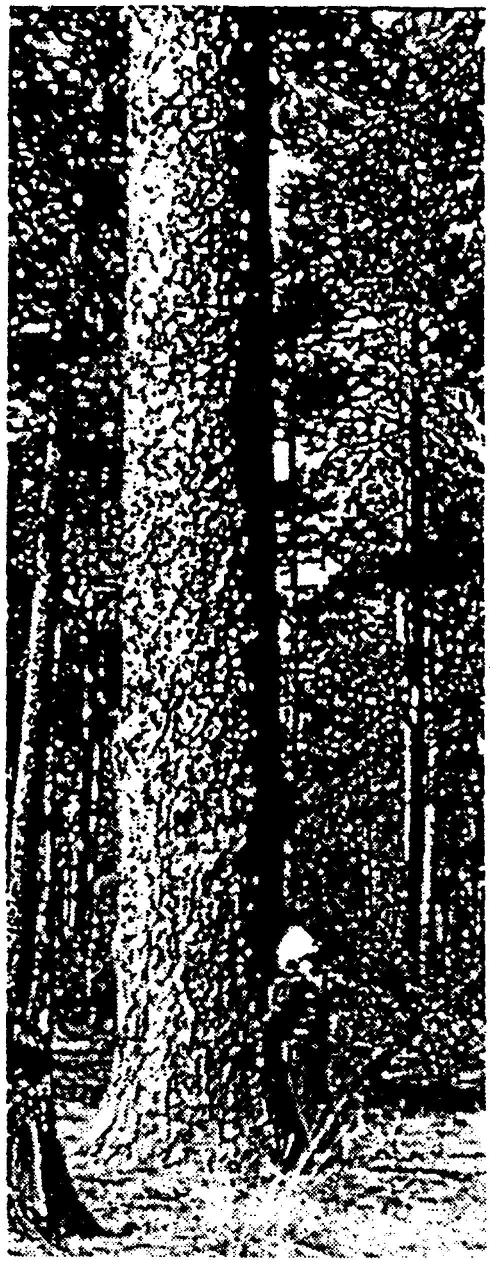


PROCEEDINGS



First Longleaf Alliance Conference

LONGLEAF PINE:
A REGIONAL
PERSPECTIVE OF
CHALLENGES AND
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Species Introductions in Longleaf Pine Groundcover Vegetation

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ABSTRACT - Longleaf pine groundcover vegetation is uniquely species rich at small to medium spatial scales. However, species richness has been reduced in many locations by a history of fire suppression and soil disturbance. It is therefore of interest to determine whether groundcover species can be successfully introduced into appropriate habitats without intensive site preparation which might further damage those habitats. We have been testing two methods for introducing species into longleaf pine groundcover vegetation in the Francis Marion National Forest: (1) as seeds, collected by machine from several sites inside and outside of the National Forest. (2) as nursery grown seedlings. The only site preparation is fire. Results indicate that wiregrass (*Aristida beyrichiana*) is readily introduced from seed (i.e., seedlings are present and increasing in size 2 years after the initial introductions), particularly in high light microhabitats without excessive woody competition. However, seed introductions are rarely successful for other species. In contrast to the seed introduction treatments, we have had good success introducing 1-2 year old seedlings. In addition to nursery grown seedlings of wiregrass, we have also outplanted toothache grass (*Ctenium aromaticum*), Indiangrass (*Sorghastrum nutans*) and the rare forb *Parnassia caroliniana*. In all cases, seedlings have shown good survival (generally > 80%). Parnassia seedlings have demonstrated the capacity to withstand periods of flooding lasting > 7 days and are increasing rapidly in size (i.e., measured as clump basal area). We conclude (1) that seedling introductions may be a useful method for enhancing species richness of longleaf pine groundcover, and (2) sites managed with frequent fire and minimal soil disturbance may serve as refugia for artificially established populations of rare groundcover plants.

INTRODUCTION

Longleaf pine groundcover vegetation is uniquely species rich at small to medium spatial scales. However, species richness has been reduced in many locations by a history of fire exclusion and soil disturbance. It is therefore of interest to determine whether groundcover species can be successfully introduced into appropriate habitats without intensive site preparation which might further damage those habitats.

METHODS

The study area is the Francis Marion National Forest (FMNF), north of Charleston, SC. There are three study sites (henceforth wet, mesic, dry) representing different types of longleaf pine dominated habitats within the Forest. Each study site is subdivided into 21 1 ha plots. Every plot is randomly assigned to one of three groups (A,B,C). Within sites and groups, plots are randomly assigned one of three burn treatments: (1) no burn, (2) burn every 2 yrs in winter, (3) burn every 4 yrs in winter, (4) growing season burn every 2 yrs, (5) growing season burn every 4 yrs, (6) growing season burn on average every 2 yrs, but with random between fire intervals, (7) growing season burns on average every 4 yrs, but with random between fire intervals. Treatments were initiated in 1993 for plots in group A. Treatments in Groups B and C were initiated in 1994 and 1995 respectively. Results described below are limited to Group A plots only.

Seed Introductions

Seeds introduced into Group A plots were obtained from five donor sites: (1) Webb Wildlife Center, Hampton County, SC. (2) Tilman Sand Ridge Preserve, Jasper County, SC (3) Venture Plantation, Williamsburg County, SC, (4) Yawkey Wildlife Center, Georgetown County, SC, (5) areas in the FMNF outside of our study plots. Donor sites were selected which had high quality groundcover including at least one species not present inside our study plots. Seeds were collected in October-December 1992. Collections at Webb and Tilman coincided with peak germinability of wiregrass (<u>Aristida beyrichiana</u>), the dominant grass at those two sites. Wiregrass does not presently occur within the FMNF.

Within each main fire treatment plot (see above) are randomly located six 1.5 x 2.0 m subplots. Half of these are randomly chosen for seed introductions, while the other three serve as controls. Each subplot is subdivided into 48 25 cm x 25 cm cells.

Pretreatment data were collected during the summer of 1992, prior to introducing the seeds. These data consisted of lists of species for each cell within every subplot. Thus, the abundance of each species in a subplot was determined as the percentage of cells in which it was found.

Seeds were introduced following 1993 treatment fires. Seeds in no burn plots were introduced at the same time as seeds in winter burn plots. In each subplot, seeds were introduced only into the central 0.5 x 2.0 m strip. This was to allow us to monitor movement, if any, of introduced species into surrounding areas.

Subplots were recensused 2 yrs later, during the 1995 growing season.

Seedling Introductions

Grasses: Three subplots were randomly located within each main fire treatment plot for grass seedling introductions. These subplots are 1.5 m x 4.0 m, also subdivided into 25 cm x 25 cm cells. One year old wiregrass and toothache grass (*Ctenium aromaticum*) seedlings, grown in a nursery at the Santee Experimental Forest, were outplanted into these subplots during January and February 1994. The grasses were planted alternately into the central 0.5 m x 4.0 strip of each subplot, leaving one open cell between each grass plug. Outplanted grasses were checked for survival in late winter 1995 and again in late winter 1996. In addition, tiller numbers were determined in 1996 for each outplanted seedling.

Parnassia caroliniana: Grass-of-Parnassus (*Parnassia caroliniana*) is a rare forb throughout the range of longleaf pine. In South Carolina it appears to be exceedingly uncommon (S1 state rank). The following chronology summarizes the activities associated with this species:

1993 Seeds

12/93	Three mature capsules collected at Bates Hill Plantation, N of Georgetown, SC
3/93	Capsule 1 seeded onto wet-soil in a growing tray at nursery
4/94	Seedlings begin to germinate.
5/94	Seeds from capsules 2-3 placed into growing trays. Most seeds fail to germinate, suggesting that germination requires a period of cool temperatures.
11/94	18 plugs outplanted into test subplot at the wet site.
12/94	Censusing initiated for leaves and clump area (estimated as area of best fitting ellipse) of outplanted plugs.
1/95	Seedlings survive two periods of heavy rain and flooding
5/95	Very dry spring; supplemental water added on three occasions.

1994 Seeds

12/94	24 capsules collected from Bates Hill Plantation (17 already open and dispersing seed; 8
12/94	2090 seeds from 17 open capsules placed into growing trays in nursery. Seeding densities and arrangements experimentally varied to test for effects on germination.
2/95	Seeds begin to germinate; seedling emergence monitored.
11/95	249 plugs planted into 7 subplots in 4 main plots at the wet site; also 56 plugs planted haphazardly within a large canopy gap in a fifth main plot.
6/95	Plugs (and seedlings within plugs) checked for overwinter survival, surface area, and leaf numbers.

RESULTS

Seed Introductions: Two yrs after the seed introductions, wiregrass seedlings were present in many (38%) of the subplots. However, few seedlings were introduced for other species. Indeed, when wiregrass was removed from the dataset, a statistical analysis (CANOCO ordination) failed to demonstrate any difference between species composition in introduction and control subplots.

The above results suggest that direct seeding of wiregrass is possible. However, we should also acknowledge that wiregrass seed introductions were not uniformly successful. To begin with, no wiregrass seedlings were established in no burn plots or at the dry study area. Also, few seedlings were present at the wet study area following seed introductions after growing season fires. The most successful rates of seedling establishment occurred at the mesic study area (over 80% of subplots had at least one seedling), regardless of season of introduction, and in the wet study site when seeds were introduced following winter burns.

Grass Seedling Introductions: After 1 yr, wiregrass plug survival was close to 100% at all three study sites. Toothache grass survival was also high, on average, though there were distinct differences among the sites. Survival of this species was lowest at the dry site and highest at the wet site. This is not too surprising, since toothache grass is normally restricted to wet savannas.

Two yrs after outplanting, wiregrass survival was still close to 90% at the wet and mesic sites, even in reburned plots. Wiregrass survival at the dry site was equivalently high, except in reburned plots, where survival averaged less than 60%. Toothache survival patterns were similar to those from the previous year, except that site differences were accentuated in the post-burn plots.

Parnassia Introductions: Of the 18 Parnassia plugs in the initial test plot (see the chronology above) all but one survived the first winter and sprouted again the following spring. Another plug succumbed in the drought that spring. Plants derived from the 16 surviving plugs have suffered no additional mortality and have continued to increase in size (as measured by surface area and leaf numbers). Plugs outplanted in autumn 1995 also showed high (> 90%) overwinter survival and early observations suggest they will be as successful as the seedlings outplanted in the first trial.

CONCLUSIONS

1. Direct seeding of wiregrass appears possible under certain conditions, even when the seedlings are subjected to competition from previously established plants. However, seedling establishment is severely depressed on dry soils and when seeds are introduced too late in the growing season.
2. Direct seeding appears much less feasible for other species, particularly when seeds are introduced into previously established vegetation.
3. Seedling introductions were much more successful, both for grass plugs and for the rare forb Parnassia caroliniana. However, observations over several years will be required to determine the ultimate success of these newly established populations.