

# Proceedings of the Fifth Longleaf Alliance Regional Conference

Longleaf Alliance Report No. 8

May 2005

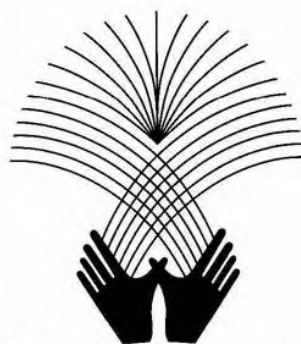


## Longleaf Pine: *Making Dollar\$ and Sense*



October 12 - 15, 2004

Hattiesburg Lake Terrace Convention Center  
Hattiesburg, Mississippi



THE LONGLEAF ALLIANCE

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## CHEMICAL CONTROL OF THE INVASIVE EXOTIC *LYGODIUM JAPONICUM*

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**Abstract:** Japanese climbing fern (JCF, *Lygodium japonicum*) is an exotic invasive which has the potential to completely infest localized areas through the formation of a thick frond mat and climbing upright vegetation. The dense mats can overtop native vegetation and change fire behavior by creating ladder fuels and smothering groundcover fuels. On Ichauway JCF is most prevalent in streamside hammocks, but is also found in upland areas which do not burn frequently. JCF is difficult to control because the spores are easily transported by wind and water, and potential herbicide treatments may damage non-target desirable species. We implemented a study to examine the effects of herbicide on JCF and non-target plants. Three blocks were chosen in three forest types: hardwood hammock, field edges, and moist depressions. Within each block, three 1 m x 1 m plots were surveyed for percent coverage of JCF and seven non-target understory species, and surrounding hardwoods documented. Each plot in a block was treated with either Arsenal (2.5 % a.i.), Glypro+ (2.0% a.i.) or Plateau (1.5% a.i.) which was broadcast applied in September 2003 using pump sprayers. Plots were surveyed two weeks and seven weeks after treatment and continue to be monitored in 2004. Early data indicate that all three herbicides effectively controlled JCF within 7 weeks of application in all three habitat types, with Glypro+ being the most effective (42 % control) followed by Arsenal (25% control). Glypro+ was also most effective at controlling non-target exotics (65 % control); Arsenal and Plateau had similar effectiveness on these species (32 % control). In September 2004 plots will be re-surveyed and any mortality of hardwoods surrounding the plots will be noted.

### INTRODUCTION

Japanese climbing fern (*Lygodium japonicum* - JCF) is a category I invasive plant, native to both temperate and tropical Asia, which has naturalized across the Southeastern United States (Lott et al. 2003, Zeller and Leslie 2004). This species has the potential to completely infest localized areas through the formation of a thick frond mat and by climbing upright vegetation. The dense mats can overtop native vegetation and change fire behavior by creating ladder fuels and smothering groundcover fuels (Lott et al. 2003). JCF is difficult to control because the spores are easily transported by wind and water (Ferriter 2001). In areas of its range where frost occurs there is some dieback, but ferns growing up the stems of trees are insulated from much of the frost damage. Fire is also useful in controlling the species in areas which burn frequently. However, most occurrences are in hardwood depressions, hardwood hammocks or along field edges, areas which do not burn well or frequently because of inundation or fire-shadow effects. Herbicide treatments may be effective in controlling the spread of JCF, yet may also damage non-target desirable species. In central and south Florida, old-world climbing fern (*Lygodium mycophyllum*), a closely related species, has become a major problem, with increases from 28,000 acres in 1993 to 110,000 acres in 1999 (Lott et al. 2003). A significant increase in JCF has been observed in parts of southwest Georgia as well. To develop management strategies to control the spread of JCF before it becomes a more serious problem, we implemented a pilot study to examine the possibility of reducing coverage using herbicides.

### METHODS

#### Study Site

This project was located at the Joseph W. Jones Ecological Research Center at Ichauway. Ichauway is a 29,000 acre ecological reserve in the Coastal Plain of southwest Georgia, USA. Over 18,000 acres are in mature (70+), upland longleaf pine (*Pinus palustris*) forests. The climate for this area is classified as humid subtropical with an average annual precipitation of 52 inches distributed evenly throughout the year. Mean daily temperatures range from 69 to 93°F in summer and 41 to 63°F in the winter. Two major waterways pass through Ichauway: 13 miles of the Flint River form the eastern boundary of the property and 15 miles of the Ichawaynochaway Creek flow through the center of the property. These aquatic systems create many acres of streamside hammocks, which, in addition to numerous wetlands scattered across the property, provide ample areas subject to JCF invasion. On Ichauway, JCF is most prevalent in wet areas, but is also found in upland areas which do not burn well or frequently.

In fall, 2002, hammocks along the waterways and other areas of Ichauway were systematically surveyed to map the locations of JCF infestations. Three site types were selected for this study: field edges, hardwood hammocks and either depressional areas or areas dominated by pines other than longleaf [i.e., loblolly pine (*P. taeda*), slash pine (*P.*

*elliottii* var. *elliottii*) or shortleaf pine (*P. echinata*)]. Three plots were established in each site type (n = 9 plots total).

### Field Measurements

In each of the nine plots, three 1 m x 1 m subplots were established. Each of the three subplots received one of the following treatments: Arsenal (2.5% imazapyr acre<sup>-1</sup>) Glypro+ (2.0% glyphosate acre<sup>-1</sup>) or Plateau (1.5% imazapic acre<sup>-1</sup>). Subplots receiving the Arsenal treatment were located a minimum of 20 ft. from the other subplots to minimize transmittance through the soil. All herbicides were broadcast applied in September 2003 using backpack sprayers. Prior to herbicide application, percent cover of JCF and seven other non-target species were recorded and photos were taken at each subplot (n = 27) and site (n = 9). Non-target species included Canada goldenrod (*Solidago canadensis*), blackberry (*Rubus cuneifolius* and *R. trivialis*), Japanese honeysuckle (*Lonicera japonica*), greenbriar (*Smilax* spp.) winged elm (*Ulmus alata*) and wood oat (*Chasmanthium latifolium*). Additionally, hardwoods within 33 ft. of the center of the Arsenal subplots were mapped and diameters at breast height were measured to determine if the herbicide negatively affected growth and/or survival. Subplots were re-surveyed approximately two, seven and 52 weeks after treatment application.

### RESULTS

At all three site types, each of the herbicide treatments effectively reduced JCF cover (Figure 1). There were no significant differences among the treatments or site types, with the exception of the Arsenal treatment 2 weeks after application. When JCF coverage was averaged across all sites, the Arsenal plots were significantly lower. This difference however, was not apparent 52 weeks after application. After 52 weeks, any JCF in the plots was a result of neighboring, untreated JCF growing into the plots. There did not appear to be any green-up of ferns rooted in the plots.

Cover of all non-target species was reduced by at least one of the herbicides (Figure 2). Eight weeks after application, the Glypro+ treatment resulted in mortality of all the non-target species except greenbriar, while Arsenal and Plateau both caused mortality of three of the non-target species. One year after treatment, many of the subplots were bare or were sparsely vegetated. Vegetative cover decreased from 83% to 22% in all plots. There were no significant differences in vegetative cover among treatments or site types.

The Arsenal treatment resulted in mortality of hardwoods surrounding the subplots in both field edge sites (33% mortality) and hardwood hammock sites (22% mortality). However, the number of hardwoods surrounding the plots varied by site type and subplot (from 0 to 24 trees). This variance and the small sample size prevent us from determining if there are significant differences in Arsenal's effects on hardwoods among the different site types. These subplots will be monitored for the next year to determine JCF re-colonization rates.

### CONCLUSIONS

Though risky to generalize results from this small-scale pilot study, all three herbicides effectively reduced JCF cover in the three habitat types. There was a corresponding decrease in overall vegetative cover and some hardwood mortality was associated with the Arsenal treatment, indicating the need for a site by site prescription for areas with important non-target species. Another study (Zeller and Leslie 2004) showed that both Accord (a.i. glyphosate) and Escort (a.i. metsulfuron methyl) were effective in controlling old-world climbing fern in central Florida, but Escort resulted in the least amount of damage to non-target understory vegetation.

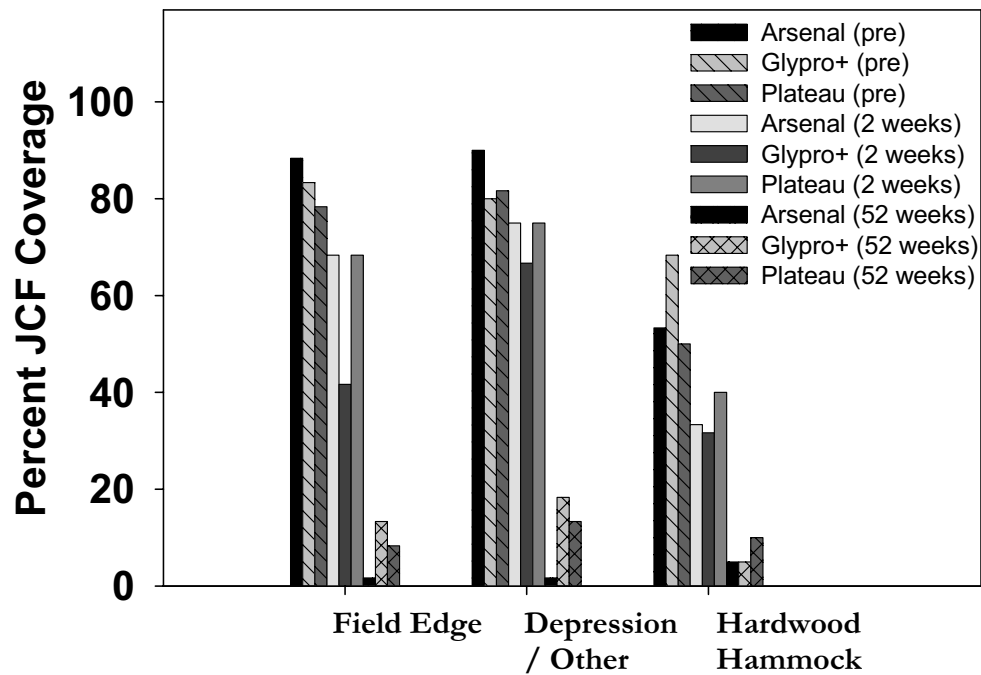


Figure 1. Effects of three different herbicides on JCF coverage over three sampling periods.

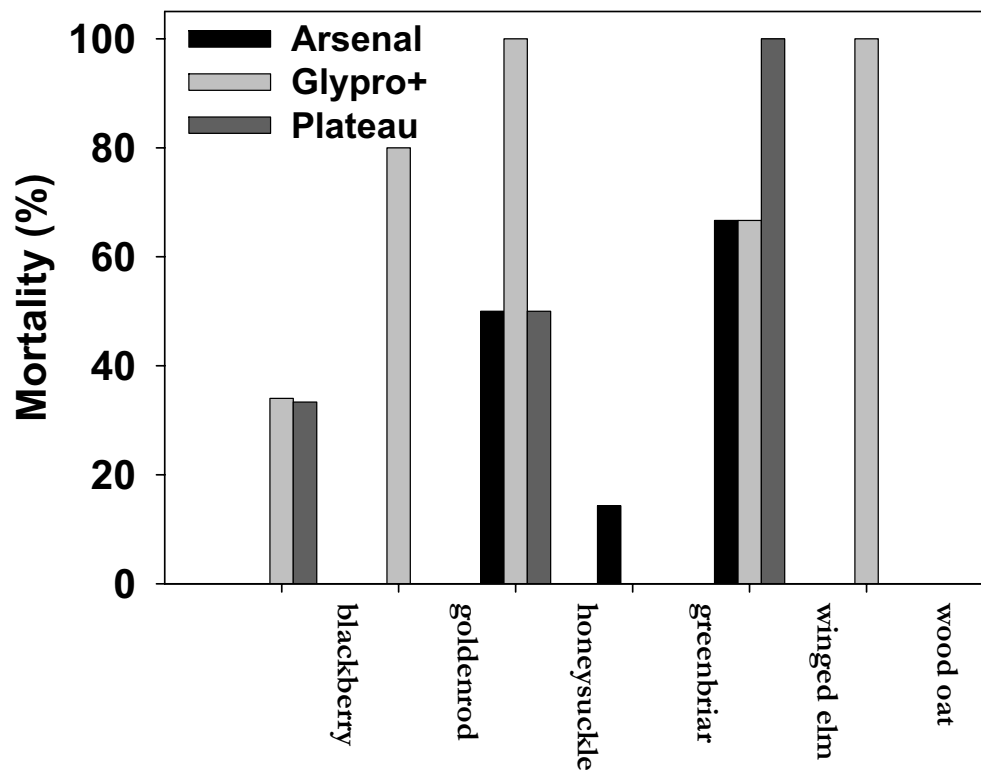


Figure 2. The effects of the different herbicides on target species eight weeks after application. These include both native and exotic species.

## **ACKNOWLEDGEMENTS**

Thanks are extended to the J.W. Jones Ecological Research Center for funding this project.

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