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212. © Longleaf pine (*Pinus palustris* P. Mill.) restoration using herbicides: overstory and understory vegetation responses on a coastal plain flatwoods site in Florida, U.S.A. Jose, S., Ranasinghe, S., and Ramsey, C. L. *Restoration Ecology* 18(2):244-251. 2010.

Longleaf Pine (*Pinus palustris* P. Mill.) Restoration Using Herbicides: Overstory and Understory Vegetation Responses on a Coastal Plain Flatwoods Site in Florida, U.S.A.

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Abstract

A study was conducted on a Coastal Plain flatwoods site in Florida to determine the effects of common forestry herbicides on Longleaf pine seedling survival and growth and on the understory vegetation. Following removal of the overstory slash pine, five low-rate herbicide treatments were applied over the top of planted Longleaf pine seedlings to provide short-term understory vegetation control and accelerate seedling growth. The objective was to increase Longleaf pine growth by reducing the shrub competition while increasing the herbaceous ground cover. Despite causing reduction in seedling survival over the control treatment, imazapyr (0.21 ac kg/ha) resulted in the highest seedling growth (height and volume). The significant reduction of shrub cover, density, and height by imazapyr was believed to be responsible for the improved seedling growth in this treatment. Both hexazinone

(0.56 ai kg/ha) and sulfometuron methyl (0.26 ai kg/ha) + hexazinone (0.56 ai kg/ha) treatments also reduced cover of Runner oak, a major shrub species, but the response was evident only 8 months after treatment. Although sulfometuron methyl (0.26 ai kg/ha) and sulfometuron methyl + hexazinone treatments did not result in any significant change in overall grass, forb, and shrub cover, both treatments resulted in greater Longleaf pine growth compared to the control. None of the herbicides significantly affected the major understory grasses and forbs. Overall, imazapyr provided the best desired results with significant increase in seedling growth and better control of shrub species with no significant effects on grass and other herbaceous species cover.

Key words: hexazinone, imazapyr, restoration, shrub control, sulfometuron methyl, understory, Wiregrass.

Introduction

Pine flatwoods constituted a major forest type in the southeastern Coastal Plain and occupied nearly 50% of the Florida peninsula until the early twentieth century (Davis 1967). Longleaf pine (*Pinus palustris* P. Mill.) dominated the upland and moderate to poorly drained sites, frequented by fires. Slash pine (*P. elliottii* Engelm.) occurred on wetter sites where fires were not prevalent (Stout & Marion 1993). Due to excessive logging, inadequate regeneration, and conversion to other species, the extent of Longleaf pine ecosystems has greatly declined. At present, Longleaf pine forests occupy about 1 million ha across the southeast, less than 3% of the original acreage (Frost 2006). There has been a great deal of interest in restoring Longleaf pine ecosystems in the recent past (Jose et al. 2006). However, information regarding the restoration of understory, overstory, and faunal components of this unique ecosystem is sorely needed.

Due to the high demand for timber and the rise of plantation forestry, many Longleaf pine-dominated sites were converted to fast-growing Slash pine and Loblolly pine (*P. taeda* L.) (Frost 2006). Longleaf pine was replaced by other pine species because of slow early growth and regeneration difficulties. It is a poor seed producer with infrequent seed crops, and the seeds require a scarified seedbed with exposed mineral soil for adequate germination (Boyer 1990; Brockway 2006). Once established, Longleaf pine seedlings exhibit a slow growth phase with little to no height initiation for several years. This slow juvenile growth phase, also known as the grass stage, is lengthened if there is increased competition for site resources (Haywood 2000; Jose et al. 2003). Such challenges are exacerbated on flatwoods sites due to the characteristic heavy understory of shrub species. The flatwoods understory is typically comprised of shrubs such as Gallberry (*Ilex glabra* L.), Saw palmetto (*Serenoa repens* Bartr.), Runner oak (*Quercus pumila* Walt.), Fetterbush (*Lyonia lucida* Lam.), Blueberry (*Vaccinium myrsinites* Chapman.), and Hairy wicky (*Kalmia hirsuta* Walt.) (Huck 1987; Ruth et al. 2008).

Prescribed fire has been widely used as a restoration tool to control understory woody vegetation resulting in

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