Final Report - Joint Fire Science Program 2001 - 01B-3-1-01

Project Title: The Flomaton Natural Area (FNA): Demonstrating the benefits of fuel management in an old-growth longleaf pine ecosystem.

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Abstract: Only a few fragments of remnant virgin, old growth longleaf pine stands remain in the Southeast, mostly hidden from easy viewing by the general public. One of the few remaining stands in private ownership is the Flomaton Natural Area; a 25 ha stand located in Escambia County, Alabama. The site is located within the city limits of Flomaton and is in close proximity to an interstate highway. Several landscape level longleaf restoration efforts are also underway on nearby public lands. With a US highway passing through the stand, this relatively small site provides a unique and highly visible opportunity to demonstrate the risks of fire exclusion and the benefits of regular prescribed fire for managing fuels in fire adapted ecosystems. It also provides the opportunity to demonstrate the economic and ecological benefits of longleaf pine regeneration for private landowners. This stand of 200+ year-old trees was burned regularly up until 1950 when all burning and fuel management ceased. Since 1995, four, low intensity prescribed fires carefully applied by cooperating partners have greatly reduced the years of unnatural fuel accumulations, and the associated risk of wildfire. The site has also been opened for the potential recovery of its understory structure and associated plant and wildlife components. The sites response to fuel management treatments and the development of interpretative materials are needed to fully capitalize the demonstration value of this site.

Project Objectives:

a. To develop a demonstration site on the Flomaton Natural Area
b. To monitoring the response of the overstory, understory and soil to prescribed fire and mechanical fuel treatments.
c. To construct an interpretative trail on site with supporting educational materials.
d. To develop an educational guide book for use in the local community schools

SUMMARY OF FINDINGS

Longleaf Pine Overstory: Prior to restoration efforts, longleaf pine accounted for 40 percent of the density and 70 percent of the basal area and there were no longleaf pine saplings less than 1-inch dbh.

The plots have been re-measured three times since 1993. The initial longleaf pine density and basal area were 256 trees acre^{-1} and 78.8 ft^2 acre^{-1}. By 1996 the density dropped to 124 trees acre^{-1} but the basal area only dropped to 77.6 ft^2 acre^{-1}. The loss in density occurred in the smaller DBH classes as no longleaf less than 3 inches dbh remained. In 2000 the density fell to 100 trees acre^{-1} and a basal area of 76.0 ft^2 acre^{-1}. By 2004, there were 91 trees acre^{-1} with a basal area of 74.9 ft^2 acre^{-1}.

The mortality of longleaf pine between 1993 and 2001 was primarily due to suppression. Between 2000 and 2004, much of the mortality was due to lightning, 48.1 percent, and associated insect attack, 23.6 percent. It appeared that the restoration efforts with the use of fire were responsible for 10.2 percent of the mortality.

Litter Layer: The major problem with the re-introduction and use of fire in the restoration process has been dealing with the accumulated fuel loads. The lethal nature of fire occurs when it kills a large portion of the feeder roots which developed over the decades or when the litter around the base of the tree burns, girdling the tree. One of the major concerns with any restoration effort needs to be the avoidance of a rapid reduction of the accumulated litter layer.

Prior to the reintroduction of fire, there were an average of 2.92, 4.79, and 8.03 tons acre^{-1} of litter, partially decomposed litter and humus in the stand, respectively. By 1997, there were 2.04, 5.02, and 6.54 tons acre^{-1} of litter, partially decomposed litter and humus and by 2003 it was 1.37, 5.15, and 5.67 tons acre^{-1}.

While progress has been made in reducing the fuel load, a tremendous amount remains. It will take several more years of careful burning to eliminate the partially decomposed litter and humus layer.

Herbaceous Layer: Prior to restoration efforts, there were a number of shrubs and woody vines and only 1 herbaceous species. After the 1997 fire, there were 23 herbaceous species. There are now 25 genera and more than 40 herbaceous plants and grasses that have appeared within the stand. Most of these species are native plants, whose seeds have been stored in the seed bank.

Longleaf Pine Regeneration: In 2002 there were 3,100 seedlings acre^{-1} across the entire stand and an average of 8,800 seedlings acre^{-1} across 5 randomly measured gaps.

Despite the litter depth, seedlings are becoming established at the FNA. The reason for this apparent success may be due to the low intensity fires and extensive mop-up efforts after burning that have been used to avoid the entire consumption of the litter layer.

Soil Elemental Dynamics: Following 4 prescribed fires at the Flomaton Natural Area, all elemental contents measured, except potassium, % N, and % C, have been significantly changed (t-test, alpha = 0.05). Strong increases (> 40%) have been observed in copper, barium, zinc, magnesium, calcium, and chromium. Losses have been the greatest (> 30%) in boron, cobalt, and manganese.

DELIVERABLES CROSSTABLE

Proposed	Delivered	Status
Annual progress reports	Progress reports completed and poster presentations made at the annual JFSP meeting when requested.	Done. The posters will be available for viewing at www.forestry.auburn.edu/lpsdl/home.html in early autumn. The proposal indicated information would be located at the following website www.longleafalliance.org but the information is being moved to a new address given above.
Monitor the response of the overstory, understory and soil to prescribed fire	The fieldwork was completed between late 2003 and early 2004.	A summary of the results is presented above. Presentations were made at the 2005 Second Montane Longleaf Alliance Regional Conference, the 2004 Ecological Society of America meeting, and the 13th Biennial Southern Silvicultural Research Conference. These publications are the result of these efforts: Kush, J.S. and R.S. Meldahl. 2006. Stand dynamics of a longleaf pine restoration project. Pp. 90-91, *In*: K.F. Conner, (ed.), Proceedings of the 13th biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-92. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 640 pp. Kush, J.S. and J.M. Varner. 2006. Burn slowly and carry a water bag: Lessons learned from re-introducing fire to a fire-suppressed longleaf pine stand. Pp. 15-18, *In*: M.L. Cipollini, (comp.), Proceedings of the second montane Longleaf Alliance conference. Longleaf Alliance Report No. 9. Kush, J.S., R.S. Meldahl, and C. Avery.

		2004. A Regeneration Success: Longleaf Pine Seedlings Established in a Fire Suppressed Old-Growth Stand. Ecological Restoration. 22(1):6-10.
Develop a demonstration area and construct an interpretative trail with supporting material	A trail was completed in early 2004.	The area has been visited by local school groups and the Auburn University School of Forestry & Wildlife Sciences. In addition, the area was used by students from the School of Forestry & Wildlife Sciences for a senior project. The website with information on the interpretative trail is being moved from www.longleafalliance.org to www.forestry.auburn.edu/lpsdl/home.html This website should be accessible in early autumn.
Develop an educational guidebook for use in local schools	A guidebook was developed in early 2005.	The website with information in the guidebook is being moved from www.longleafalliance.org to www.forestry.auburn.edu/lpsdl/home.html This website should be accessible in early autumn.