

VEGETATION OF THE PUSHMATAHA WILDLIFE  
MANAGEMENT AREA, PUSHMATAHA  
COUNTY, OKLAHOMA

By

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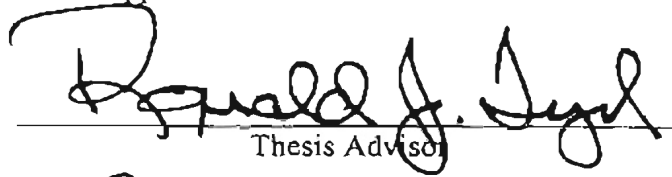
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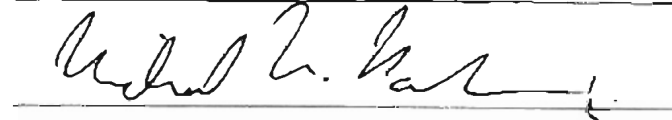
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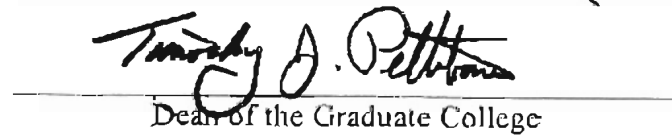
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*Good timber does not grow with ease.  
The stronger the wind, the stronger the trees.*

- J. Willard Marriott

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# CHAPTER I

## ORGANIZATION OF THESIS

This thesis comprises two parts, each of which encompasses one component of the masters research conducted between 2000 and the present. Chapter II describes the results of a floristic survey of the vascular plants of the 7,690-ha Pushmataha Wildlife Management Area (PWMA) located in the Kiamichi Mountains of southeastern Oklahoma. Chapter III examines the impacts of timber and fire management on understory plant species richness, evenness, and composition in the Pushmataha Forest Habitat Research Area (PFHRA) located within the PWMA. Appendix A lists the species of the PWMA arranged alphabetically by family with their common name, relative abundance, and nativity. Appendix B includes a list of species with general habitat and author's collection numbers. Appendix C is a list of plant taxa encountered in 20 x 50m Whittaker plots in the PFHRA including the relative abundance for each taxon present. Both chapters will be submitted for publication in scientific journals and included as part of a final report for Federal Aid Project W-150-R-1.



## CHAPTER II

### VASCULAR FLORA OF THE PUSHMATAHA WILDLIFE MANAGEMENT AREA, PUSHMATAHA COUNTY, OKLAHOMA

ABSTRACT.— A two-year floristic survey of the 7,690-ha Pushmataha Wildlife Management Area (PWMA) located in the Kiamichi Mountains of southeastern Oklahoma revealed the known vascular flora to comprise 447 species in 287 genera and 96 families. The four largest families—Poaceae, Asteraceae, Fabaceae, and Cyperaceae—compose 43.4% of the flora. The largest genera are *Carex*, *Juncus*, *Dichanthelium*, *Desmodium*, and *Lespedeza*. Native species account for 92.8% of the taxa. Three introduced species appear to be naturalizing in the area: *Elaeagnus angustifolia*, *Lespedeza cuneata*, and *Sorghum halepense*. Thirteen species designated as rare by the Oklahoma Natural Heritage Inventory were encountered: *Dulichium arundinaceum*, *Justicia ovata* var. *lanceolata*, *Brachyelytrum erectum*, *Calamovilfa arcuata*, *Piptochaetium avenaceum*, *Smilax smallii*, *Ilex opaca*, *Ribes cynoshati*, *Tilia americana* var. *caroliniana*, *Polygala polygama*, *Carex oxylepis*, *Carex oklahomensis*, and *Mitchella repens*.

#### INTRODUCTION

The 7,690-ha Pushmataha Wildlife Management Area (PWMA) was established by the Oklahoma Department of Wildlife Conservation during the 1940s as a deer refuge. Cattle grazed the area from the time of establishment until the 1960s. From the mid-1960s to the present, much of the area has been burned at 1- to 5-year intervals and the timber selectively harvested (R.E. Masters and J. Waymire *pers. comm.*). The vegetation

of the area was first mentioned by Nuttall in his 1818-1820 travel journals (Thwaites 1905). Based on the description of his journey, Nuttall traveled along the Kiamichi River through an area that is presumably now the PWMA or near it. He described it as "...hemmed in with lofty pine hills..." with areas "...covered with grass, and mostly a prairie of undulated surface." The PWMA has a history of frequent anthropogenic and lightning-caused fires which likely preserved this mosaic of vegetation types (Curtis 1956, Pyne 1982, Masters 1991). With the implementation of fire suppression during the 1920s, the PWMA changed from an area dominated by pines and hardwoods intermixed with open prairies to one predominantly forested. Currently, the overstory is dominated by *Pinus echinata*, *Quercus stellata*, *Quercus marilandica*, and *Carya tomentosa*. Common understory taxa are *Toxicodendron radicans*, *Parthenocissus quinquefolia*, *Desmodium* spp., *Lespedeza* spp., *Panicum* spp., *Dichanthelium* spp., and *Schizachyrium scoparium*.

The PWMA is located in the corner of Oklahoma that has the highest floristic diversity, but has had few comprehensive surveys (Hoagland 2000). Only three intensive studies of the flora of southeastern Oklahoma have been conducted. Smith (1997) encountered 359 species in the 5,701-ha McCurtain County Wilderness Area, and Means (1969) documented 992 species in a survey of the 362,000-ha San Bois Mountains, which occur in portions of Pushmataha, Leflore, and Latimer counties. Masters (1991) recorded 220 species in a 30-ha research area within the PWMA. The Oklahoma Natural Heritage Inventory (1997) lists nearly 50 rare or imperiled plant species that occur in Pushmataha County.

In the PWMA, large-scale management treatments, especially different fire regimes, have been implemented in order to create or restore habitats preferred by wildlife (Jack Waymire *pers. comm.*). An understanding of the effectiveness of these management plans and their impact on rare or imperiled species is dependent upon knowledge of the plant species present, their abundance, and their distribution within the area. In addition, knowledge of the presence of exotic invasive species, their abundance, and their potential for establishment and spread is essential. To meet this need for information about the flora of the PWMA, a floristic survey was conducted. Specific objectives were three: (1) to compile a list of species encountered on the area; (2) to identify exotic invasive species; and (3) to locate rare or imperiled taxa.

#### THE WILDLIFE MANAGEMENT AREA

The PWMA is located in northern Pushmataha County, Oklahoma (Figure 1). It lies in the steep and rugged Kiamichi Mountains along the western edge of the Ouachita Highland Providence (Curtis and Ham 1972) (34.551-34.475N, 95.465-95.305W). The geology belongs to the Ouachita foldbelt, thus rocks date to the Mississippian, Lower Pennsylvanian and Lower Cretaceous, with terrace deposits and alluvium in the valleys (Visher et al. 1978, Pitt et al. 1982). Elevation of the area ranges between 150 and 400 meters. Slopes typically have southeastern and northwestern aspects. The Kiamichi River and four major creeks dissect the area and are fed by small, intermittent streams nestled in short drainages. Ridge tops and their adjacent valleys vary in elevation by as much as 200 meters. In their survey of the county's soils, Bain and Watterson (1979) describe most of the PWMA as having thin, rocky, drought-prone cherty shales and

resistant sandstones, belonging to the Carnasaw-Pirum-Clebit association with areas of rock outcrop. Along the Kiamichi River, the soils are well-drained with a loamy surface layer and a clayey or loamy subsoil belonging to the Tuskahoma-Sherwood-Clebit association. Surface soil varies in depth from 0-30 cm, and the texture is stony fine sandy loam.

The climate of the PWMA is semi-humid to humid with hot summers and mild winters (Masters 1991). Based on data collected (Oklahoma Climatological Survey 2002) near the area in Clayton, OK, the growing season averages 305 days per year, from March to December. The hottest months are July and August with mean temperatures of 27.7 °C and 27.2 °C respectively. The coldest months are January and February with a mean temperature of 5.5 °C. Approximately 350 days a year average temperatures above 0.0 °C. Annual average rainfall is 115.9 cm. The wettest months are March and December with 12.9 cm and 15.8 cm of rainfall respectively.

The vegetation of the area is characterized as a mixed pine hardwood forest (Bruner 1931, Hoagland 2000). Upland sites in the PWMA generally have a closed canopy composed of *Pinus echinata*, *Carya tomentosa*, and *Quercus stellata*. The understories in these areas are dominated by legumes, *Schizachyrium scoparium*, *Aster* spp., *Panicum* spp., and *Dichanthelium* spp. The adjacent valleys mainly have *Acer rubrum*, *Liquidambar styraciflua*, and *Ostrya virginiana* in the canopy, and, depending on the season, *Podophyllum peltatum*, *Sanicula canadensis*, and *Chasmanthium latifolium* below. *Betula nigra*, *Cephalanthus occidentalis*, *Cyperus* spp., and *Juncus* spp. are common along the many small waterways.

## INVENTORY OF FLORA

To conduct the floristic survey, I traversed the PWMA monthly on foot during the growing seasons of 2001 and 2002. One trip was conducted in April of 2003. I collected a total of 67 days. Intensive collecting was done in the Pushmataha Forest Habitat Research Area (PFHRA) because of a related study on the effects of timber harvesting and fire frequency on groundcover. Three voucher specimens were collected for each species encountered. Plants were collected in flower and/or fruit when possible and prepared using standard herbarium techniques (Womersley 1981). If there were less than 20 individuals of a taxon in an area, or if the taxon was listed as S1, S2 or S3 by the Oklahoma Natural Heritage Inventory (1997), photographs were taken instead of collecting and included with deposited voucher specimens. The locations of these "rare" species were recorded using GPS coordinates and USGS topographic maps and then submitted to the Oklahoma Natural Heritage Inventory. One voucher specimen was deposited in the Oklahoma State University Herbarium (OKLA), one was donated to the Tall Timber Research Station, Tallahassee, FL, and the last given to the manager of the PWMA.

Nomenclature and designation of nativity follow that of the PLANTS database (USDA, NRCS 1999) with the exception of *Carex aureolensis*, which is not listed in the database, and misspellings. In these instances, nomenclature follows that of Tyrl et al. (2002). Species are considered native if they are indigenous to North America. If the origins were reported as both native and introduced, the species were included in calculations as native. The relative abundance of each species was determined using the five-category system— abundant, frequent, occasional, infrequent, and rare— developed

by Palmer et al. (1995). At the conclusion of fieldwork, all rankings were re-evaluated. In addition, associated species and ecological information were recorded. Plants not immediately recognized were subsequently identified using state and regional floras and herbarium specimens in the Oklahoma State University herbarium (Steyermark 1963; Correll and Johnson 1979; Smith 1994; Tyril et al. 2002). Intraspecific taxa were identified when necessary to determine their status as rare or imperiled. Herbaria were not searched for additional records. This flora follows the standards of Palmer, Wade, and Neal (1995).

#### FLORA OF THE PWMA

The known flora of the PWMA consists of 447 species in 287 genera and 96 families (Table 1, Appendices A and B). Poaceae (66 species), Asteraceae (65 species), Fabaceae (36 species), and Cyperaceae (27 species) compose 43.4% of the flora. The largest genera are *Carex* (15 species), *Juncus* (9 species), *Dichanthelium* (8 species), *Desmodium* (7 species), and *Lespedeza* (6 species).

There are 415 native species, which account for 92.8% of the species. *Elaeagnus angustifolia*, *Lespedeza cuneata*, and *Sorghum halepense* are the only introduced species that appear to be naturalizing on the PWMA according to the criteria outlined by Rejmanek and Richardson (1996). Species designated as rare by the Oklahoma Natural Heritage Inventory (1997) include: *Dulichium urundinaceum* (S1), *Justicia ovata* var. *lanceolata* (S1), *Brachyelytrum erectum* (S1), *Calamovilfa arcuata* (S2), *Piptochaetium avenaceum* (S2), *Smilax smallii* (S2), *Ilex opaca* (S2S3), *Ribes cynosbati* (S1S2), *Tilia americana* var. *caroliniana* (S1S2), *Polygala polygama* (S2), *Carex oxylepis* (S2),

*Mitchella repens* (S2S3), and *Carex oklahomensis* (S?). Plants designated as endangered, threatened, or candidate by the U. S. Fish and Wildlife Service (2001) were not encountered in this study.

#### LITERATURE CITED

- Bain, W. R., and A. Watterson, Jr. 1979. *Soil Survey of Pushmataha County, Oklahoma*. U.S. Dep Agric. Soil Conserv. Serv., Washington, D.C.
- Bruner, W. E. 1931. The vegetation of Oklahoma. *Ecol. Monogr.* 1:100-186.
- Correll, D. S., and M. C. Johnson. 1979. *Manual of the vascular plants of Texas, Vol. 6*. The University of Texas at Dallas, Richardson, TX.
- Curtis, J. T. 1956. The modification of mid-latitude grasslands and forests by man. *In*: Thomas, W.L. (ed.). *Man's role in changing the face of the earth*, pp. 721-736. University of Chicago Press, Chicago, Illinois.
- Curtis, N. M., W. E. Ham, K. S. Johnson, C. C. Branson, M. E. Marcher, and J. F. Roberts. 1972. *Geology and Earth Resources of Oklahoma*. Okla. Geol. Surv. Educ. Publ. No. 1, Norman, Oklahoma.
- Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. *Southwest. Nat.* 45:385-420.
- Masters, R. E. 1991. *Effects of timber harvest and periodic prescribed fire on wildlife habitat and use in the Ouachita Mountains of eastern Oklahoma*. Ph.D. Dissertation, Okla. State Univ., Stillwater, Oklahoma.
- Means, F. H. 1969. *Vascular Plants of Southeastern Oklahoma from the Sans Bois to the Kiamichi Mountains*. Ph.D. Dissertation, Okla. State Univ., Stillwater,

Oklahoma.

- Oklahoma Climatological Survey. 2002. Mesonet Climatological Data Summary: CLAY. University of Oklahoma, Norman, Oklahoma.
- Oklahoma Natural Heritage Inventory. 1997. Short Working List of Rare Plants. Version of 22 January 1997. Distributed by Oklahoma Biological Survey, Norman, Oklahoma.
- Palmer, M. W., G. L. Wade, and R. Neal. 1996. Standards for the writing of floras. *BioScience* 45:339-345.
- Pitt, W. D., R. O. Fay, L. R. Wilson, and J. A. Curiale. 1982. *Geology of Pushmataha County Oklahoma*. Eastern New Mexico University Studies in the Natural Sciences Special Publication No. 2, Portales, New Mexico.
- Pyne, S. J. 1982. *Fire in America: A Cultural History of Wildland and Rural Fire*. Princeton University Press, Princeton, New Jersey.
- Rejmanek, M. and D. M. Richardson. 1996. What attributes make some plant species more invasive? *Ecology* 77:1655-1661.
- Smith, B. A. 1997. *Floristic investigations of the flora of Oklahoma*. Ph.D. Dissertation, Okla. State Univ., Stillwater, Oklahoma.
- Smith, E. B. 1994. *Keys to the Flora of Arkansas*. University of Arkansas Press, Fayetteville. 363p.
- Steyermark, J. A. 1963. *Flora of Missouri*. Iowa State University Press, Ames, IA.
- Thwaites, R. G. 1905. *Journal of Travels into the Arkansas Territory during the Year 1819*. The Arthur H. Clark Company, Cleveland, Ohio.
- Tyrl, R., S. Barber, P. Buck, J. Estes, P. Folley, L. Magrath, C. Taylor, and R. Thompson.



2002. *Keys and Descriptions for the Vascular Plants of Oklahoma*. Flora Oklahoma, Inc., Noble, Oklahoma.
- U.S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants 50 CFR 17.11 and 17.12, December 1999.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 1999. The PLANTS database (<http://plants.usda.gov/plants>). National Plant Data Center, Baton Rouge, Louisiana.
- Visor, G., C. Stone, and B. Haley. 1978. *Field Guide to Structure and Stratigraphy of the Ouachita Mountains and the Arkoma Basin*. Proceedings of the 1978 annual meeting of the American Association of Petroleum Geologists, Oklahoma City, Oklahoma.
- Womersley, J. S. 1981. *Plant Collecting and Herbarium Development: A Manual*. Food and Agriculture Organization of the United Nations, Rome.

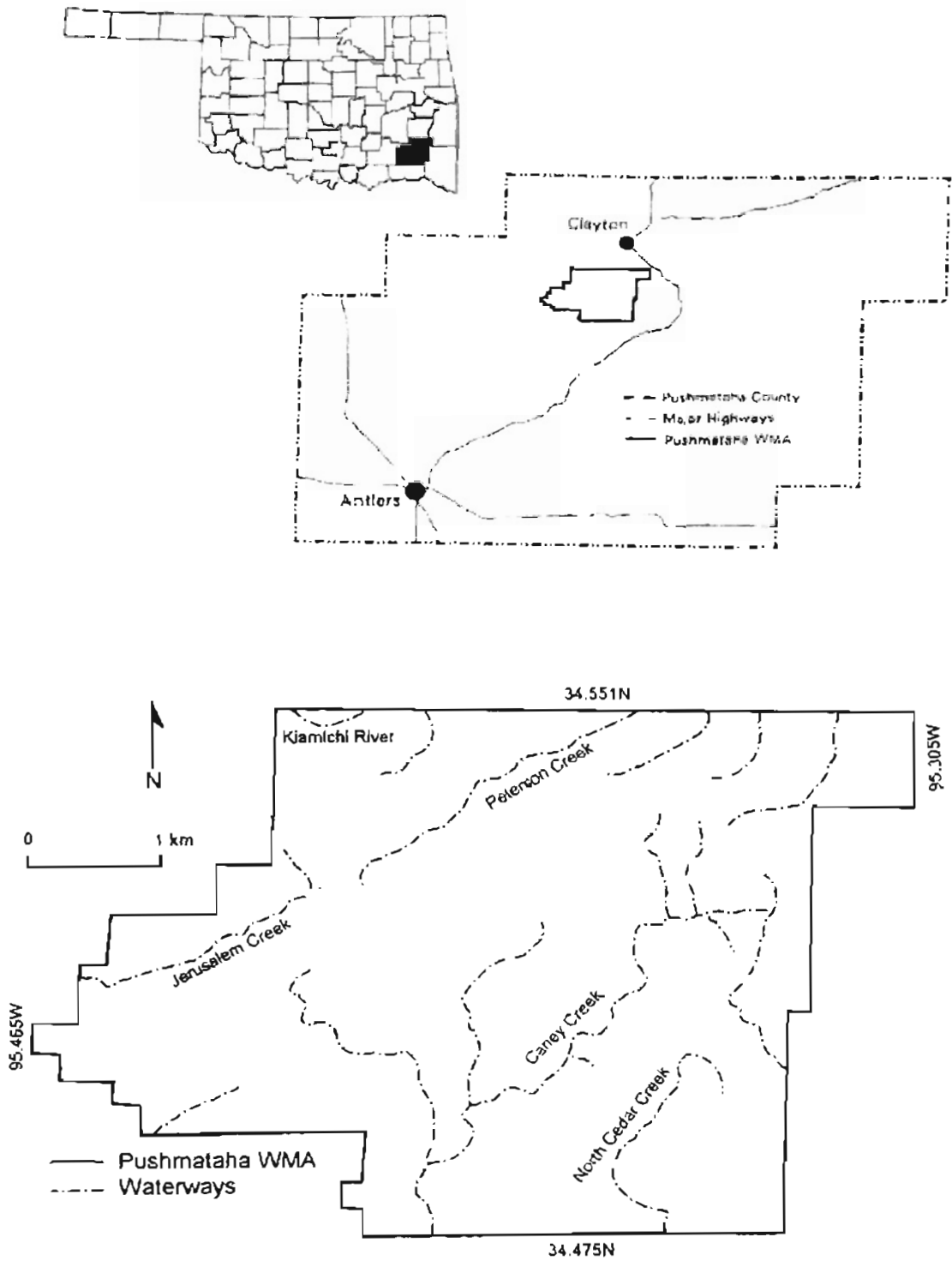


Figure 1. Location and major waterways of the Pushmataha Wildlife Management Area.

Table 1. Taxa encountered in the Pushmataha Wildlife Management Area. No additional infraspecific taxa were found.

	Families	Genera	Species		
			Native	Introduced	Total
Pteridophyta	5	6	6	0	6
Coniferophyta	1	2	3	0	3
Magnoliophyta					
Magnoliopsida	76	212	296	21	317
Liliopsida	14	67	110	11	121
<b>Total Taxa</b>	<b>96</b>	<b>287</b>	<b>415</b>	<b>32</b>	<b>447</b>

## CHAPTER III

### RESPONSE OF HERBACEOUS PLANT COMMUNITIES TO TIMBER AND FIRE MANAGEMENT IN AN OKLAHOMA PINE-HARDWOOD FOREST

ABSTRACT.—I examined the impacts of timber and fire management on understory plant species richness, diversity, and composition in the Pushmataha Forest Habitat Research Area, Pushmataha County, Oklahoma. Ten treatment regimes were replicated 1–3 times in a completely randomized design and sampled using 0.1 ha Whittaker plots. The treatments were: (1) control; (2) winter, rough-reduction burn treatment; (3) clearcut, mechanical site preparation, and summer site preparation burn treatment; (4) harvest *Pinus echinata* only and annual burn treatment; (5) thin hardwoods and an annual burn treatment; and (6) five harvest *Pinus echinata* and thin hardwood treatments with no burn, or four-, three-, two-, and one-year burn intervals. I found that: (1) grass and legume species dominate the burned treatments, whereas *Toxicodendron radicans*, *Quercus marilandica*, and *Carya tomentosa* dominate understory of unburned treatments and controls; (2) species richness in the unburned and burned treatments differ significantly; (3) species-area curves indicate that more frequent fires maximize species richness; (4) the Saturation Hypothesis is supported at all spatial scales; (5) evenness is highest in the season following a burn rotation; (6) the understory community composition responds to a canopy cover gradient; and (7) clearcutting, the number of burns over 18 years, no timber harvesting, and harvesting pines/thinning hardwoods significantly change the understory species composition.

Key words: fire frequency, fire ecology, timber management, Ouachita Mountains

## INTRODUCTION

Fire changes species composition in both grasslands and woodlands, and is an important ecological factor in many vegetation types worldwide (e.g. Oosting, 1956; White, 1979; Wright and Bailey, 1982; Glitzenstein *et al.*, 1995; Bond and van Wilgen, 1996; Johnson, 1992). In these vegetation types, the local fire regime can strongly influence vegetation composition and dynamics. Fire return interval is an important aspect of any fire regime (Waldrop *et al.*, 1992; Glitzenstein *et al.*, 1995; Schimmel and Granström, 1996; Glitzenstein *et al.*, 2003). Shorter burn intervals favor fire-adapted herbaceous species; whereas longer burn intervals allow woody species to increase (Bragg and Hulbert, 1976; Waldrop *et al.*, 1992).

The initial post-fire plant community is composed primarily of surviving individuals (Armour *et al.*, 1984; Rego *et al.*, 1991). New species then appear on the sites opened by the fire and thereby increase the area's species richness. In the absence of fire, the abundance of these species will progressively decline as the pre-fire community reestablishes on the site (Hodgkins, 1958; Johnston and Elliot, 1996). Thus, regulation of fire frequency can be used to maintain desired plant communities (Bond and van Wilgen, 1996; Engle *et al.*, 2000; Higgins *et al.*, 2000; Glitzenstein *et al.*, 2003).

It is well documented that richness and diversity of herbaceous species, and total forb abundance typically increase after fire (Waldrop *et al.*, 1992; Wright and Baily, 1982; Rego *et al.*, 1991; Masters *et al.*, 1995; Wilson *et al.*, 1995; Sparks *et al.*, 1998). Frequent or annual fires decrease woody species and thereby increase the amount of light reaching the forest floor (Waldrop *et al.*, 1992; Armour *et al.*, 1984). Fires also decrease litter accumulation that can suppress seed germination, seedling establishment, and

growth of herbs (Lewis and Harshbarger, 1976; Xiong and Nilsson, 1999; Brown and Smith, 2000). Longer intervals will favor strong competitors, decrease species diversity, and potentially create higher spatial heterogeneity (Connell, 1978; Huston, 1979; Sousa, 1984).

Several hypotheses have been proposed to explain the response of understory vegetation to different fire frequencies (Glitzenstein *et al.*, 2003). The Intermediate Disturbance Hypothesis states that high species diversity will typically occur at intermediate levels of disturbance (Connell, 1978; Pickett and White, 1985). The Most Frequent Fire Hypothesis suggests that burning as often as fuels will allow is the best strategy for maintaining species richness and composition (Glitzenstein *et al.*, 2003). The Saturation Hypothesis states that increasing fire frequency will only increase species richness to a threshold after which no additional effect can be detected (Mehlman, 1992; Glitzenstein *et al.*, 2003). Finally, there is the possibility that species richness decreases after a threshold is reached. This idea is referred to as the Frequent Fire Species Loss Hypothesis (Collins *et al.*, 1995; Engle *et al.*, 2000).

Native, mixed pine-hardwood associations in North America have a history of naturally occurring fires that maintain species composition common to the vegetation type (Curtis, 1956; Komarek, 1983; Pyne, 1982). The Pushmataha Forest Habitat Research Area (PFHRA) is one such mixed-pine hardwood forest in southeastern Oklahoma (Bruner, 1931). The vegetation of the area was first mentioned by Nuttall in his 1818-1820 travel journals (Thwaites 1905). Based on the description of his journey, Nuttall traveled along the Kiamichi River through an area that is presumably near the PFHRA. He described it as "...hemmed in with lofty pine hills..." with areas

“...covered with grass, and mostly a prairie of undulated surface.” Prior to European settlement, Native Americans used fire extensively as a management tool (Masters *et al.*, 1995; Hoagland, 2000). Historic accounts indicate that upland pine-oak associations were burned annually which likely promoted a mosaic of vegetation types with sparse or well-spaced pines and oaks (Vogl, 1974; Masters *et al.*, 1995; Wilson *et al.*, 1995). With the implementation of fire suppression during the 1920s, the Ouachita Mountains changed from an area dominated by pines and hardwoods intermixed with open prairies to one predominantly forested.

The PFHRA was established in 1982 to evaluate responses of its vegetation to a variety of timber harvest and prescribed fire regimes and to determine possible forest management alternatives for large-scale application in wildlife management areas (Masters, 1991). Masters (1991) and Masters *et al.*, (1993) studied vegetation response in the PFHRA from 1984 to 1990 and found that it was related to canopy cover, basal area, litter accumulation, and burn interval. Principal observations were that: (1) *Schizachyrium scoparium* and *Andropogon gerardii* dominated the harvested and winter-burned treatments; (2) grass and legume production increased with burns at 1- and 2-year intervals, whereas woody species richness decreased; (3) woody species and canopy cover increased in the unburned plots and those that burned at 3- and 4-year intervals; and (4) *Schizachyrium scoparium* increased in frequency and percent ground cover in clearcuts and the summer-burn treatment.

These ongoing studies in the PFHRA have not evaluated the long-term response of the understory plant communities to the various timber management and fire regimes. The groundcover was sampled partially from 1983 to 1990, but understory species

composition has not been evaluated since 1990 and has never been sampled systematically and intensively. Therefore, the objective of the work reported here was to determine the response of understory vegetation to a range of management techniques in mixed-pine hardwood forests of the PFHRA. This array of disturbances also presented the opportunity to test species richness hypotheses over a long period of time.

### Methods

*Study area.*—The PFHRA is a 29.1-ha tract located in the Pushmataha Wildlife Management Area, Pushmataha County, Oklahoma (Masters *et al.*, 2002) (Fig. 2). Cattle grazed the area until the mid-1960s. From the mid-1960s until 1982, portions of the area were burned at 1- to 5-year intervals and the timber selectively harvested (Masters and Waymire, personal communication).

PFHRA lies in the steep and rugged Kiamichi Mountains along the western edge of the Ouachita Highland Province (34.53N, 95.36W). Elevation of the study area is approximately 335 m, and the soils are thin, rocky, drought-prone cherty shales and resistant sandstones, belonging to the Carnasaw-Pirum-Clebit association with areas of rock outcrop. The slope is 5-15% with a southeastern aspect (Bain and Watterson, 1979).

*Experimental design.* Eight treatments were applied to 23 different 1.2–1.6-ha plots in a completely randomized design beginning in the summer of 1984 (Masters, 1991) (Fig. 3). The research site was expanded to 26 plots in 1993, when monitoring was initiated in two treatments established in 1982. The habitat manipulations were timber harvesting and prescribed fire (Table 2). Some of the harvested plots were allowed to regenerate naturally, whereas others were placed on a 1- to 4- year burn cycle.



Prescribed burns using strip-head fires began in the winter of 1985 and have continued to the present (Masters *et al.*, 2002).

*Vegetation sampling.*—I surveyed treatment plots for species composition during June 2001 and 2002 using a 20 x 50 m (0.1 ha) Whittaker plot located in its center (Peet *et al.*, 1998). Each was located at least 20 m from any edge to avoid edge effects (Mueller-Dombois, 1974; Masters, 1991). Each sampling plot was divided into 10 modules that were 10 x 10 m (0.01 ha) (Fig. 4). Four of the modules were sampled intensively for presence of species under 1 m. These modules each contained two series of subquadrats with four levels of nesting at 0.01, 0.1, 1.0, and 10 m<sup>2</sup>. The remaining six modules were considered aggregate and sampled at the 0.01 ha level. After all nests in a module were completed, percent cover was determined at the 0.01 level using cover classes (Peet *et al.*, 1998). I deposited voucher specimens of plants encountered in the Oklahoma State University Herbarium (OKLA) (Appendix C). Nomenclature follows that of the PLANTS database (USDA, NRCS, 1999).

*Data analysis.* I used vegetation samples to calculate species richness and evenness ( $H'/H'max$ ) at the 0.1 ha level (Ludwig and Reynolds, 1988; Smith and Wilson, 1996; Mason *et al.*, 2002). Evenness was defined as the ratio of the observed Shannon-Weiner Diversity Index to the maximum possible evenness (Smith and Wilson, 1996). Burn sequence differences were not considered a significant factor due to the length of the study and number of cumulative burns. Herbivory was not addressed as a confounding factor on the vegetation due to the results of a previous study on the area (Masters *et al.*, 1993). The data were tested for homogeneity of variance using Levene's test (Steele and Torrie, 1980). Results for homogeneity of variance were not significant;

therefore I used a one-way ANOVA to test for differences between variances for each treatment ( $P \leq 0.005$ ). Mean ranks were then separated using a Least Significant Difference (LSD) pairwise comparison. Evenness was correlated with years since burn and number of burns over 18 years using simple linear regression, using SAS (Steele and Torrie, 1980; SAS, 1999).

I performed Detrended Correspondence Analysis (DCA) using CANOCO Version 4.0 to analyze the species composition data (ter Braak, 1986; 1995). DCA is a multivariate indirect gradient analysis that uses species abundance data to display species and treatment plot locations along important, inferred environmental gradients (ter Braak, 1986). DCA axes are in units of beta diversity (Gauch, 1982). DCA was used to analyze species abundance to determine changes in species composition between treatments; changes in location of a treatment plot along the axes indicate corresponding differences in species composition (ter Braak, 1986). Species abundances were square-root transformed before analysis to reduce the importance of the most abundant species.

I performed Canonical Correspondence Analysis (CCA), a direct gradient analysis, using CANOCO Version 4.0 to analyze the species composition data in relation to nominal environmental variables describing the treatments (ter Braak, 1986; Jongman *et al.*, 1995). A Monte Carlo permutation test was used to test the importance of the environmental variables ( $P \leq 0.005$ ) but, because the test is exploratory, significance was not interpreted strictly (Hallgren *et al.*, 1999). All variables deemed insignificant using forward selection were excluded from analysis (Jongman, *et al.*, 1995). Species abundances were square-root transformed before analysis.

## RESULTS

Fire frequency and timber management have a significant effect on species richness in the PFHRA ( $F=2.15$ ,  $P=0.04$ ). Treatment plots that are burned at 1-, 2-, and 4-year intervals have significantly greater species richness than those plots with less frequent or no fire (Fig. 5). HT3, HT, and CCSP treatments do not significantly differ from the controls.

Fire has a significant effect on species richness at all spatial scales for the harvest pines/thin hardwoods treatments (Fig. 6). The F-value indicating the strength of the statistical relationship between fire frequency and species richness decreased at higher and lower spatial scales (Table 3). The patterns of species richness at fine spatial scales ( $< 10\text{m}^2$ ) are potentially due to a rarefaction effect, but small scale patterns reveal important trends (Palmer and White, 1994; Palmer *et al.*, 2000). An LSD pairwise comparison indicates that the burned and unburned treatments are significantly different at all spatial scales. Furthermore, at the highest spatial scale, only the HT1 and HT2 treatments differ significantly from the unburned treatments.

Species richness increases with the inclusion of fire (Fig. 7). At the fine spatial scales (0.01 and 0.1  $\text{m}^2$ ), trends in species richness are difficult to ascertain, but they generally follow the same pattern as the broader spatial scales. As the fire frequency is increased from the 4-year burns to the 1-year burns, there is a small increase in species richness. Broader spatial scales reveal a large increase in species richness between the unburned HT treatments and the HT4 treatments. At the intermediate spatial scales (10 and 100  $\text{m}^2$ ), the species richness decreases from the 2- to 1- year burns. This is likely due to noise in the data.

The understory plant evenness is weakly affected by timber and fire management ( $F=4.38$ ,  $P=0.041$ ) (Fig. 8). A simple multiple regression for the treatment plots that are burned indicates that 13.4% of the variation in evenness is explained by the time since burn. The CONT and HT treatments were excluded from regression analysis due to uncertainty about time since last burn. The number of burns over 18 years and evenness are not significantly correlated.

A DCA of the PFHRA reveals a canopy cover gradient (Fig. 9). Axes one and two have eigenvalues of 0.186 and 0.057, respectively. DCA axis one is related to amount of canopy cover; treatments with high average canopy cover occur towards the right of the axis. I tentatively interpret axis two as a disturbance gradient related to clearcutting. I was not able to interpret DCA axis three.

The number of burns over 18 years and the practices of clearcutting, harvesting pines/thinning hardwoods, and no timber harvesting account for 44.3% of the explained variation in the CCA (Fig. 10). The practices of clearcutting and harvesting pines/thinning hardwoods are negatively related to no timber harvesting and the number of burns over 18 years. Illustrating the relationship of species with these environmental variables, the abundance of *Toxicodendron radicans* and *Scleria oligantha* are negatively correlated with timber harvesting. Similarly, the abundance of *Dichantherium acuminatum* and *Clitoria mariana* are positively related to clearcutting. The abundance of *Andropogon gerardii*, *Schizachyrium scoparium*, *Stylosanthes biflora*, and *Dichantherium sphaerocarpon* are positively associated with the number of burns over 18 years and harvesting pines/thinning hardwoods.

If the unburned treatments (HT and CONT) are removed from the CCA, fine scale differences among the 1 to 4-year fire intervals can be ascertained. The number of burns over 18 years and the practices of no timber harvesting and thinning hardwoods account for 23.0% of the explained variation in the CCA (Fig. 11). Many of the most abundant species in the treatment plots are almost equally correlated with the practice of no timber harvesting and the number of burns over 18 years. *Andropogon gerardii*, *Schizachyrium scoparium*, and *Helianthus hirsutus* are positively correlated with the number of burns over 18 years. *Solidago ulmifolia* and *Scleria oligantha* are negatively associated with no timber harvesting.

Plots with frequent fire share few taxa with the CONT and HT treatments. This makes the treatments easy to distinguish by their dominant species alone. Grasses such as *Schizachyrium scoparium* and *Andropogon gerardii* dominate the 1- and 2- year burns. *Aristida purpurascens*, *Erigeron strigosus* and *Stylosanthes biflora* dominate all of the burned units, and *Dichanthelium acuminatum*, *Clitoria mariana*, and *Callicarpa americana* dominate the clearcut sites. Fire intolerant species, such as *Vitis palmata*, *Parthenocissus quinquefolia*, and several arborescent species, such as *Caryu tomentosa*, *Quercus marilandica*, and *Vaccinium arboreum* dominate the control and unburned sites.

## DISCUSSION

Fire-maintained understory communities have higher species richness than ones in which fire is suppressed (e.g. Oosting, 1944; Lewis and Harshbarger, 1976; Masters *et al.*, 1993; Varner *et al.*, 2003). This study of the PFHRA was no exception. Two hundred and twenty-two species were encountered during sampling. The number of

species in a single 0.1 ha Whittaker plot varied from 53 in a CONT treatment to 102 in an HT2 treatment.

The vegetation in natural communities can be altered by manipulating the fire regime (Tester, 1989; Masters, 1991; Sparks *et al.*, 1998). Both fire frequency and time of burn have an effect on understory plant community composition (Hodgkins, 1958; Collins, 2000). In tallgrass prairies, perennial forbs are favored with winter or early-spring burning, whereas late-spring burning encourages grasses, such as *Andropogon gerardii* and *Sorghastrum nutans* (Towne and Owensby, 1984). Short fire intervals cause grass and legume dominated communities, and long fire intervals promote an increase in woody stems (Bragg and Hulbert 1976; Tester, 1989). In the PFHRA, treatments with more frequent fire intervals (2- and 1-year burn intervals) were dominated by species most adapted to frequent fire. Species commonly encountered in burned treatments, such as *Andropogon gerardii*, *Schizachyrium scoparium*, and legumes, have been well documented as responding favorably to fire (Peet *et al.*, 1975; Lewis and Harshbarger, 1976; Masters *et al.*, 1993). In contrast, treatments with less frequent fire promoted communities dominated by species less fire tolerant. Vines, such as *Parthenocissus quinquefolia* and *Vitis palmata*, and woody sprouts, such as *Vitis palmata* and *Quercus marilandica*, were indicative of areas where fire was suppressed.

Several hypotheses concerning the relationship between fire frequency and species richness have been evaluated at different spatial scales in other vegetation types (Glitzenstein *et al.*, 2003). In the PFHRA, patterns in species richness were consistent regardless of spatial scale. The inclusion of fire significantly increased the number of species, but increasing the burn frequency beyond a 4-year burn regime maintains species

richness at a nearly constant level. Thus, all spatial scales support the Saturation Hypothesis; increasing the burn interval beyond the threshold point has little additional effect on the understory species richness. Mehlman's (1992) research in an old field *Pinus taeda* suggests that the threshold is six years. Longer burn intervals are needed in the PFHRA to determine whether the threshold point in a pine-hardwood forest differs from other systems.

If fire is removed from an area normally exposed to recurring fire, successional species will likely be lost and the number of species will decrease (Peet *et al.*, 1983). The CONT and HT treatments in this study did not differ statistically in species richness at all spatial scales. This is because, in the absence of fire, the growth of small saplings and sprouts is uninhibited. As a result, they contribute to the canopy cover and litter layer, thereby suppressing the growth of understory herbaceous taxa (De Grandpré *et al.*, 1993). I predict that the HT treatments, in the absence of fire, will revert to the pre-treatment conditions with late-successional species dominant.

Understory density increases after fire in various vegetation types (e.g. Hodgkins, 1958; Schimmel and Granström, 1996; Hiers *et al.*, 2000). Fire is an important component of cross timbers where burning results in the development of even-aged black-jack oak understories and increases the density of woody stems (Hoagland *et al.*, 1999). Upland woodlands rely on fire to control exotic invasive species and increase the density of native understory species (Schwartz and Heim, 1996). In prairies, frequent fire is needed to reduce litter accumulation and increase spatial heterogeneity (Collins, 1992). In the PFHRA, both timber harvesting and fire frequency had a profound effect on the understory community composition and increased the abundance of grasses and legumes.

This was likely due to increased light reaching the understory vegetation (Rheinheimer, 1959; Schlüter, 1966; Scheller and Mladenoff, 2002).

Lewis and Harshbarger (1976) stated that frequent fires over long periods are needed to create and maintain open grasslands. Prairies have high flammability throughout the growing season indicating that frequent, widespread fires were probably common in presettlement prairies (Bragg, 1982). Fire is essential in southeastern pine savannas to reduce the densities of hardwood shrubs and trees and increase grasses and legumes (Lemon, 1949; Platt, 1999). In the PFHRA, annual and biennial burns are the most effective in suppressing woody growth and maintaining an open understory after timber harvesting with the vegetation subsequently dominated by grasses and forbs. Three- and four- year burns favor some woody species, because they are allowed to sprout and reach a level of maturity at which their morphology allows them to survive a fire (Barton, 1994; Schimmel and Granström, 1996 ). The absence of fire after timber harvesting in the HT treatment plots has created a dense pine-hardwood midstory after timber harvesting.

Disturbance is a major force structuring understory species composition (Ewing and Engle, 1988; De Grandpré *et al.*, 1993). This may explain why the management practices of clearcutting and harvesting pine/thinning hardwoods had a significant effect on the species composition in the PFHRA. In particular, the CCSP treatment plots had a high level of disturbance as compared to the other treatments, because they were manipulated with contour ripping and replanting with *Pinus taeda* in addition to timber harvesting and summer site preparation burning (Masters, 1991; Sparks *et al.*, 1998).



Fire is a natural and integral component of mixed-pine hardwood forests of the Ouachita Mountains (Masters *et al.*, 1995; Sparks *et al.*, 1998). Pines are fire adapted; thus in fire-suppressed oak-pine associations, the inclusion of fire promotes pines and reduces the dominance of hardwoods (McKenzie *et al.*, 1996). Systems with the most frequent fires tend to be dominated by pines, whereas those with infrequent fires support diverse forests dominated by late-successional species (Cain and Shelton, 1994; Hartnett and Krofta, 1989; Vose *et al.*, 1994).

Restoration is essential in the Ouachita Mountains to open the canopy and increase the density of understory species. The observations presented here are consistent with those reported previously from this site (Masters, 1991; Masters *et al.*, 1993). Research in the PFHRA implies that timber harvesting coupled with a 3 to 4- year interval will restore historic communities similar to those described by early travelers. These frequencies permit some trees to reach a level of maturity that allows them to survive a fire while maintaining rich understory vegetation. Frequent, periodic burning over long periods should be utilized to reduce the cover of hardwood sprouts and support the grasses and forbs typical of fire-dependent grassland communities.

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## LITERATURE CITED

- Armour, C. D., S. C. Bunting and L. F. Neuenschwander. 1984. Fire intensity effects on the understory in ponderosa pine forests. *J. Range Manage.*, 37:44-49.
- Bain, W. R. and A. Watterson. 1979. Soil survey of Pushmataha County, Oklahoma. U.S. Dep Agric. Soil Conserv. Serv., Washington, D.C. 77 p.
- Barton, A. M. 1994. Gradient analysis of relationships among fire, environment, and vegetation in a southwestern USA mountain range. *Bull. Torr. Bot. Club*, 121:251-265.
- Bond, W. J. and B. W. van Wilgen. 1996. *Fire and plants*. Chapman and Hill, New York, NY. 263 p.
- Bragg, T. B. 1982. Seasonal variations in fuel and fuel consumption by fires in a bluestem prairie. *Ecology*, 63:7-11.
- \_\_\_\_\_ and L. C. Hulbert. 1976. Woody plant invasion of unburned Kansas bluestem prairie. *J. Range Manage.*, 29:19-24.
- Brown, J. K. and J. K. Smith, eds. 2000. Wildland fire in ecosystems: Effects of fire on flora. USDA, Forest Service, Gen. Tech. Rep. RMRS-QTR-42-vol. 2, Ogden, UT.
- Bruner, W. E. 1931. The vegetation of Oklahoma. *Ecol. Monogr.*, 1:100-186.
- Cain, M.D. and M. G. Shelton. 1994. Indigenous vegetation in a southern Arkansas pine-hardwood forest after a half century without catastrophic disturbances. *Nat. Areas Journal*, 14:1665-174.
- Collins, S.L. 1992. Fire frequency and community heterogeneity in tallgrass prairie vegetation. *Ecology*, 73:2001-2006.

- \_\_\_\_\_. 2000. Disturbance and community stability in native tallgrass prairie. *Am. Nat.*, **155**:311-325.
- \_\_\_\_\_, S. M. Glenn and D. J. Gibson. 1995. Experimental analysis of intermediate disturbance and initial floristic composition: decoupling cause and effect. *Ecology* **76**:486-492.
- Connell, J. H. 1978. Diversity in tropical rain forests and coral reefs. *Science*, **199**:1302-1310.
- Curtis, J. T. 1956. The modification of mid-latitude grasslands and forests by man, pp. 721-736. In: Thomas, W. L. (ed.). Man's role in changing the face of the earth. University of Chicago Press, Chicago, IL.
- DeGrandpré, L., D Gagnon and Y. Bergeron. 1993. Changes in the understory of Canadian southern boreal forest after fire. *J. Veg. Sci.*, **4**:803-810.
- Engle, D. M., M. W. Palmer, C. J. Crockett, R. L. Mitchell and R. Stevens. 2000. Influence of late season fire on early successional vegetation of an Oklahoma prairie. *J. Veg. Sci.*, **11**:135-144.
- Ewing, A. L. and D. M. Engle. 1988. Effects of Late Summer Fire on Tallgrass Prairie Microclimate and Community Composition. *Am. Mid. Nat.*, **120**:212-223.
- Gauch, H. G. 1982. *Multivariate analysis in community ecology*. Cambridge University Press, New York, NY. 298p.
- Glitzenstein, J. S., W. J. Platt and D. R. Streng. 1995. Effects of fire regime and habitat on tree dynamics in north Florida longleaf pine savannas. *Ecol. Monogr.*, **65**:441-476.
- \_\_\_\_\_, D. R. Streng and D. D. Wade. 2003. Fire frequency effects on longleaf pine

- (*Pinus palustris* Mill.) vegetation in South Carolina and Northeast Florida, USA. *Nat. Areas Journal*, **23**:22-37.
- Hallgren, E., M. W. Palmer and P. Milberg. 1999. Data diving with cross validation: an investigation of broad scale gradients in Swedish weed communities. *J. Ecology*, **87**:1037-1051.
- Hartnett, D. C. and D. M. Krofta. 1989. Fifty-five years of post-fire succession in a southern mixed hardwood forest. *Bull. Torr. Bot. Club*, **116**:107-113.
- Hiers, J. K., R. Wyatt and R. J. Mitchell. 2000. The effects of fire on legume reproduction in longleaf pine savannas: is a season selective?. *Oecologia*, **76**:353-363.
- Higgins, S. I., W. J. Bond and W. S. Trollope. 2000. Fire, resprouting and variability: a recipe for grass-tree coexistence in savanna. *J. Ecology*, **88**: 213-229.
- Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. *Southwest. Nat.* **45**:385-420.
- \_\_\_\_\_, I. H. Butler, F. L. Johnson and S. Glenn. 1999. The cross timbers, pp. 231-245. *In*: Anderson, R. C., J. S. Fralish, and J. M. Baskin (eds.). *Savannas, barrens, and rock outcrop plant communities of North America*. Cambridge Press, New York.
- Hodgkins, E. J. 1958. Effects of fire on undergrowth vegetation in upland southern pine forests. *Ecology*, **39**: 36-46.
- Huston, M. 1979. A general hypothesis of species diversity. *Am. Nat.* **133**:81-101.
- Johnson, E. A. 1992. *Fire and vegetation dynamics: studies from the North American boreal forest*. Cambridge University Press, New York, NY. 229 p.
- Johnston, M. H. and J. A. Elliott. 1996. Impacts of logging and wildfire on an upland

- black spruce community in northwestern Ontario. *Environ. Monit. Assess.*,  
39: 283-297.
- Jongman, R. H., C. J. ter Braak and O. F. Van Tongeren. 1995. *Data analysis in  
community and landscape ecology*. Cambridge University Press, New York, NY.  
299 p.
- Komarek, E. V. 1983 Fire as an anthropogenic factor in vegetation ecology. pp. 77-83.  
*In: Holzer, W., M. J. A. Werger, and I. Ikusima (eds.). Man's impact on  
vegetation*. Dr. W. Junk Publishers, The Hague, The Netherlands.
- Lemon, P. C. 1949. Successional responses of herbs in the longleaf-slash pine forest  
after fire. *Ecology*, 30:135-145.
- Lewis, C. E. and T. J. Harshbarger. 1976. Shrub and herbaceous vegetation after 20  
years of prescribed burning in South Carolina Coastal Plain. *J. Range Manage*,  
29: 13-18.
- Ludwig, J. A. and Reynolds, J. F. 1988. *Statistical ecology*. John Wiley and Sons, New  
York, NY. 337 p.
- Mason, N. W. H., K. MacGillivray, J. B. Steel and J. B. Wilson. 2002. Do plant  
modules describe community structure better than biomass? A comparison of  
three abundance measures. *J. Veg. Sci.*, 13:185-190.
- Masters, R. E. 1991. *Effects of timber harvest and periodic prescribed fire on wildlife  
habitat and use in the Ouachita Mountains of eastern Oklahoma*. Ph.D. Thesis,  
Okla. State Univ., Stillwater. 351 p.
- \_\_\_\_\_, R. L. Lochmiller and D. M. Engle. 1993. Effects of timber harvest and  
prescribed fire on white-tailed deer forage production. *Wildl. Soc. Bull.*,

21:401-411.

- \_\_\_\_\_, J. E. Skeen and J. Whithead. 1995. Preliminary fire history of McCurtain Co. Wilderness Area and implications for red-cockaded woodpecker management, pp. 168-176. *In*: Nodvin, S.C. and T. A. Waldrop (eds.). *Fire and the environment: ecological and cultural perspectives*. USDA, Forest Service, General Technical Report SE-69, Asheville, NC.
- \_\_\_\_\_, J. Waymire, J.A. Howard, and R.M. Crandall. 2002. Progress Report: Forest Stewardship Grant, Forest Wildlife Assistance, 2000-2001. Oklahoma State University, Stillwater, OK. 36 p. Available from: OSU Department of Forestry.
- McKenzie, D., D. L. Peterson and E. Alvarado. 1996. Predicting the effect of fire on large-scale vegetation patterns in North America. USDA, Forest Service, Res. Pap. PNW-RP-489, Portland, OR.
- Mehlman, D. W. 1992. Effects of fire on plant community composition of North Florida second growth pineland. *Bull. Torr. Bot. Club*, 119:376-383.
- Mueller-Dombois, D. and H. Ellenberg. 1974. *Aims and methods of vegetation ecology*. John Wiley and Sons, New York, NY. 574 p.
- Oosting, H. J. 1944. The comparative effect of surface and crown fire on the composition of a loblolly pine community. *Ecology*, 25:61-69.
- \_\_\_\_\_. 1956. *The study of plant communities*. 2ed. W. H. Freeman and Company, San Francisco, CA. 440 p.
- Palmer, M. W., D. B. Clark and D. A. Clark. 2000. Is the number of tree species in small tropical forest plots nonrandom? *Comm. Ecol.*, 1:95-101.
- \_\_\_\_\_, and P. S. White. 1994. Scale dependence and the species-area

- relationship. *Am. Nat.*, **144**:717-740.
- Peet, M., R. Anderson and M. S. Adams. 1975. Effect of fire on big blue stem production. *Am. Mid. Nat.*, **94**:15-26.
- Peet, R. K., D. C. Clenn-Lewin and J. Walker-Wolf. 1983. Prediction of man's impact on plant species diversity: a challenge for vegetation science, pp. 41-54. *In*: Holzner, W., M. J. A. Werger and I. Kusima (eds.). *Man's impact on vegetation*. Dr. W. Junk Publishers, The Hague, The Netherlands.
- Peet, R. K., T. R. Wentworth and P. S. White. 1998. A flexible multipurpose method for recording vegetation composition and structure. *Castanea*, **63**:262-274.
- Platt, W. J. 1999. Southeastern pine savannas. *In*: Anderson, R. C., J. S. Fralish, and J. M. Baskin (eds.). *Savannas, barrens, and rock outcrop plant communities of North America*, pp. 23-51. Cambridge Press, New York.
- Pickett, S. T. A. and P. S. White. 1985. *The Ecology of Natural Disturbance and Patch Dynamics*. Academic Press, Orlando. 472 p.
- Pyne, S. J. 1982. *Fire in America: a cultural history of wildland and rural fire*. Princeton University Press, Princeton, NJ. 54 p.
- Rego, F. C., S. C. Bunting and J. M. da Silva. 1991. Changes in understory vegetation following prescribed fire in maritime pine forests. *For. Ecol. and Manage.*, **41**:21-31.
- Rheinheimer, G. 1959. Changes in the relative amount of light and the ground vegetation in spruce forest. *Ber. Deutsch. Bot. Ges.*, **72**:246-250.
- SAS. 1999. *SAS/STAT user's guide, version 7*. SAS Institute, Cary, NC.
- Scheller, R. M. and D. J. Mladenoff. 2002. Understory species patterns and diversity in

- old-growth and managed northern hardwood forests. *Ecol. Appl.*, 12:1329-1343.
- Schimmel, J. and A. Granström. 1996. Fire severity and vegetation response in the boreal Swedish Forest. *Ecology*, 77: 1436-1450.
- Schlüter, H. 1966. Light and temperature measurements in the vegetation zone of a clearing in spruce forest. *Flora B.*, 156:133-154.
- Schwartz, M. W. and J. R. Heim. 1996. Effects of prescribed fire on degraded forest vegetation. *Nat. Areas Journal*, 16:184-191.
- Smith, B. and J. B. Wilson. 1996. A consumer's guide to evenness indices. *Oikos*, 76:70-82.
- Sousa, W.P. 1984. The role of disturbance in natural communities. *Ann. Rev. Ecol. Syst.*, 15:353-91.
- Sparks, J. C., R. E. Masters, D. M. Engle, M. W. Palmer and G. A. Bukenhofer. 1998. Effects of late growing-season and late dormant-season prescribed fire on herbaceous vegetation in restored pine-grassland communities. *J. Veg. Sci.*, 9:133-142.
- Steele, R. G. D. and Torrie, J. H. 1980. *Principles and procedures of statistics, a biometrical approach*. 2ed. McGraw-Hill Book, New York, NY. 666 p.
- ter Braak, C. J. F. 1986. Canonical correspondence analysis: a new eigenvalue technique for multivariate direct gradient analysis. *Ecology*, 67:1167-1179.
- \_\_\_\_\_. 1995. Ordination. In: Jongman, R. H., C. J. ter Braak and O. F. Van Tongeren (eds.). *Data analysis in community and landscape ecology*, pp. 91-173. Cambridge University Press, New York, NY.
- Tester, J. R. 1989. Effects of fire frequency on oak savanna in east-central Minnesota.



*Bull. Torr. Bot. Club*, **116**:134-144.

Thwaites, R. G. 1905. *Journal of Travels into the Arkansas Territory during the Year 1819*. The Arthur H. Clark Company, Cleveland, Ohio.

Towne, G. and C. Owensby. 1984. Long-term effects of annual burning at different dates in ungrazed Kansas tallgrass prairie. *J. of Range Manage.*, **37**:392-397.

USDA, NRCS. 1999. The PLANTS database (<http://plants.usda.gov/>). National Plant Data Center, Baton Rouge, LA.

Varner, J. M., J. S. Kush and R. S. Meldahl. 2003. Vegetation of frequently burned Old-growth longleaf pine (*Pinus palustris* Mill.) Savannas on Choccolocco Mountain, Alabama, USA. *Nat. Areas Journal*, **23**:43-52.

Vogl, R. J. 1974. Effects of fire on grasslands. *In*: Kozłowski, T. T., and C. E. Ahlgren (eds.). *Fire and ecosystems*, pp. 139-194. Academic Press, New York.

Vose, J.M., B. D. Clinton and W. T. Swank. 1994. Fire drought, and forest management influences on pine-hardwood ecosystems in the southern Appalachians. *In*: Proceedings of the 12<sup>th</sup> conference on fire and forest meteorology; 1993 October 26-28; Jekyll Island, GA. Soc. of Am. Foresters, Publ. 94-02, Bethesda, MD.

Waldrop, T. A., D. L. White and S. M. Jones. 1992. Fire regimes for pine-grassland communities in the southeastern United States. *For. Ecol. Manage.*, **47**:195-210.

White, P. S. 1979. Pattern, process, and natural disturbance in vegetation. *Bot. Rev.*, **45**: 229-299.

Wilson, C. W., R. E. Masters and G. A. Bukenhofer. 1995. Breeding bird response to pine-grassland community restoration for red-cockaded woodpeckers. *J. Wildl.*

*Mange.*, **59**:56-67.

Wright, H. A. and A. W. Bailey. 1982. *Fire ecology*. John Wiley and Sons, New York, NY. 501 p.

Xiong, S. and C Nilsson. 1999. The effects of plant litter on vegetation: a meta-analysis. *J. Ecology*, **87**:984-994.

**Table 2.** Ten management treatments in the Pushmataha Forest Habitat Research Area (Masters *et al.*, 2002).

Treatment	Acronym	Number of Replications	Year Burned																		
			1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Control, no treatment	CONT	3																			
Rough Reduction Burn; burn every 4 years	RRB	3	.				.				.				.				.		
Harvest Pine, No Thinning of Hardwood; burn every year	HNT1 <sup>b</sup>	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Harvest pine, Thin hardwood; no burning	HT <sup>a</sup>	2																			
Harvest pine, Thin hardwood; burn every 4 years	HT4	3	.				.				.				.				.		
Harvest pine, Thin hardwood; burn every 3 years	HT3	2	.			.			.			.			.			.			.
Harvest pine, Thin hardwood; burn every 2 years	HT2 <sup>b</sup>	3	.		.		.		.		.			.		.		.		.	
Harvest pine, Thin hardwood; burn every year	HT1 <sup>b</sup>	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clearcut and site preparation, planted to <i>Pinus taeda</i>	CCSP	3	.											.						.	
Thin hardwoods; burn every year	PBS	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

<sup>a</sup> Treatment units established in 1982, but monitoring was started in 1993.

<sup>b</sup> Treatment units were not burned in 1995 due to unfavorable conditions

Table 3. Summary of ANOVA statistics for species richness at different spatial scales.

Area	Mean SR	Std. Dev.	F-statistic*	<i>P</i>
0.01	1.23	0.86	17.37	<0.0001
0.1	3.56	2.12	20.45	<0.0001
1	9.50	4.75	28.08	<0.0001
10	21.50	8.00	18.83	<0.0001
100	41.53	9.51	9.79	<0.0001
1000	74.91	12.21	4.12	0.0069

\*df=9 for each

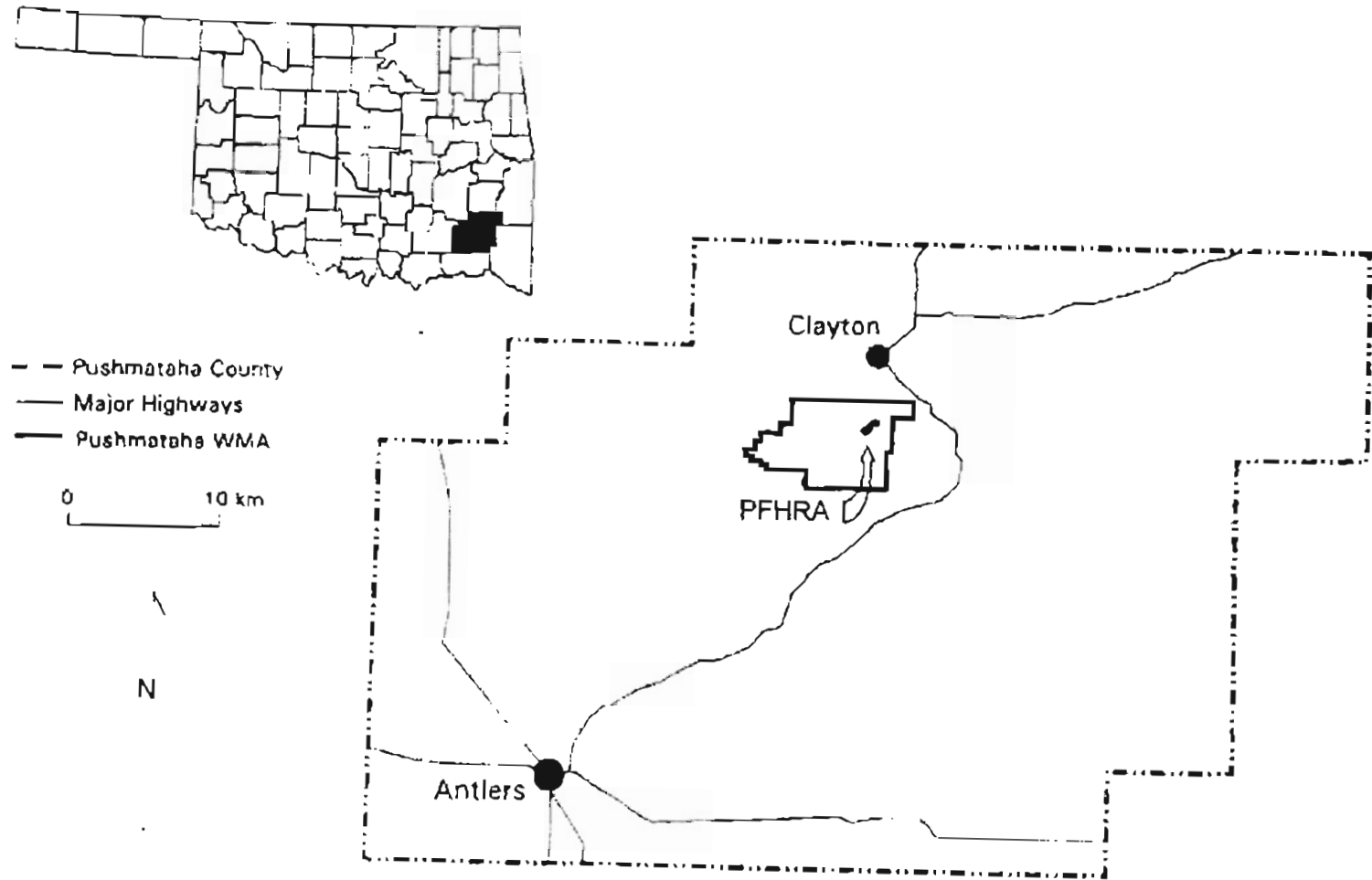


Figure 2. Location of the Pushmataha Forest Habitat Research Area (PFHRA), Pushmataha County, Oklahoma (adapted from Masters *et al.*, 2002).

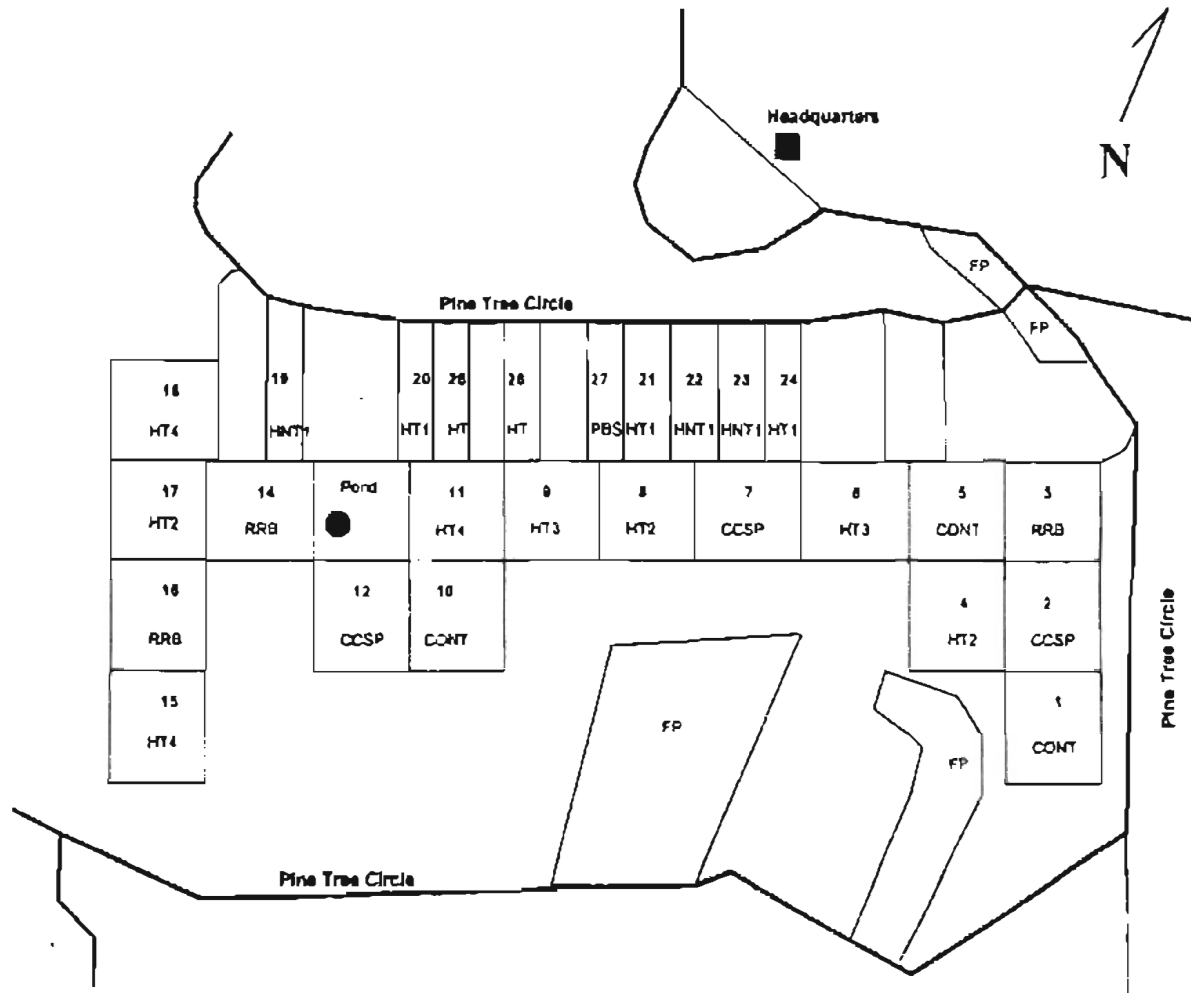


Figure 3. Plot layout in the Pushmataha Forest Habitat Research Area (adapted from Masters et al., 2002). See Table 1 for the definition of each acronym.

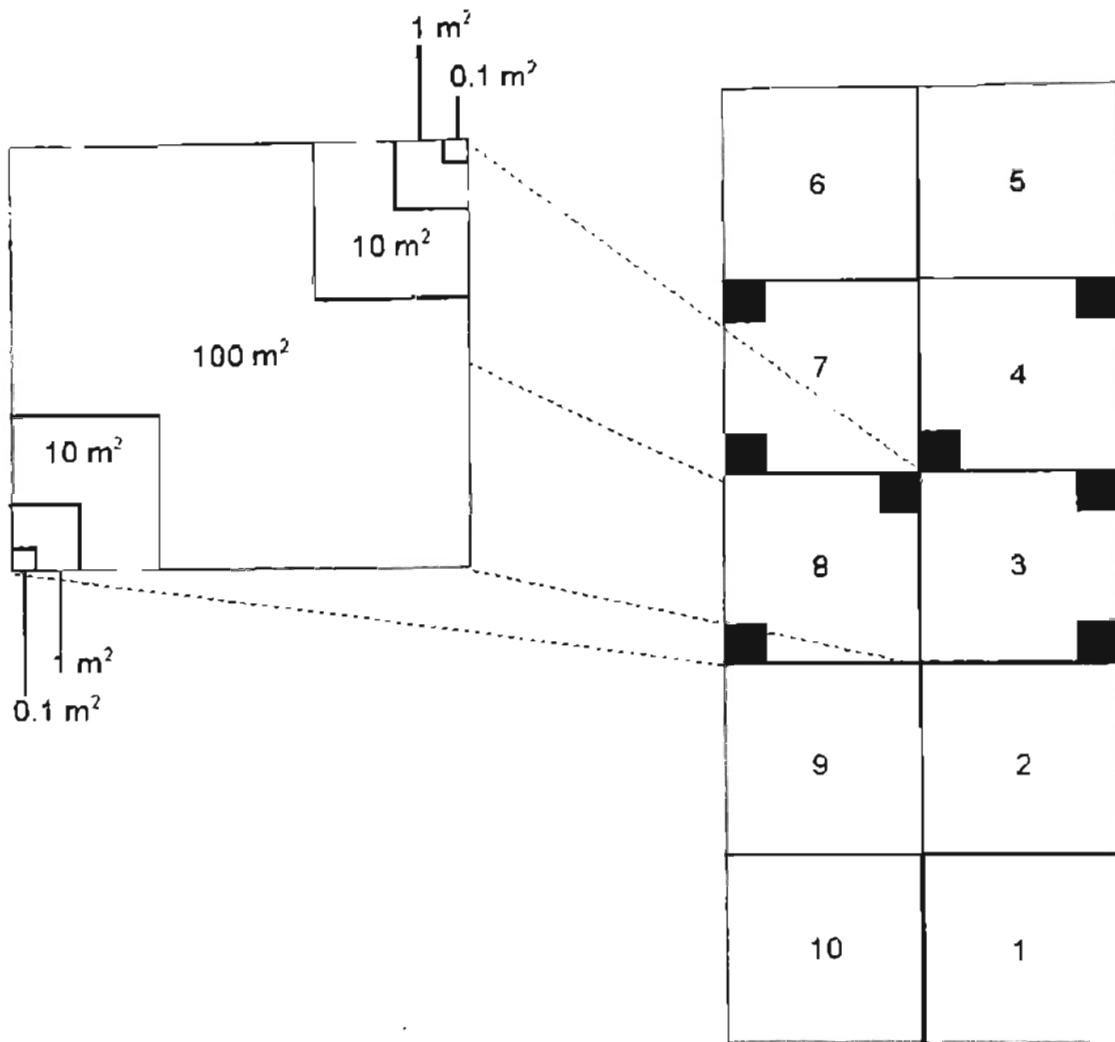


Figure 4. Diagrammatic representation of a 20 x 50 m (0.1 ha) Whittaker plot divided into 10 modules (0.01 ha). Four of the modules (3,4,7,8) were sampled intensively using subquadrats with four levels of nesting at 0.01, 0.1, 1.0, and 10 m<sup>2</sup> (black squares). The subquadrats were positioned so they did not share boundaries. The remaining modules (1, 2, 5, 6, 9, 10) were considered aggregate and sampled at the 0.01 ha level (Peet *et al.*, 1998).

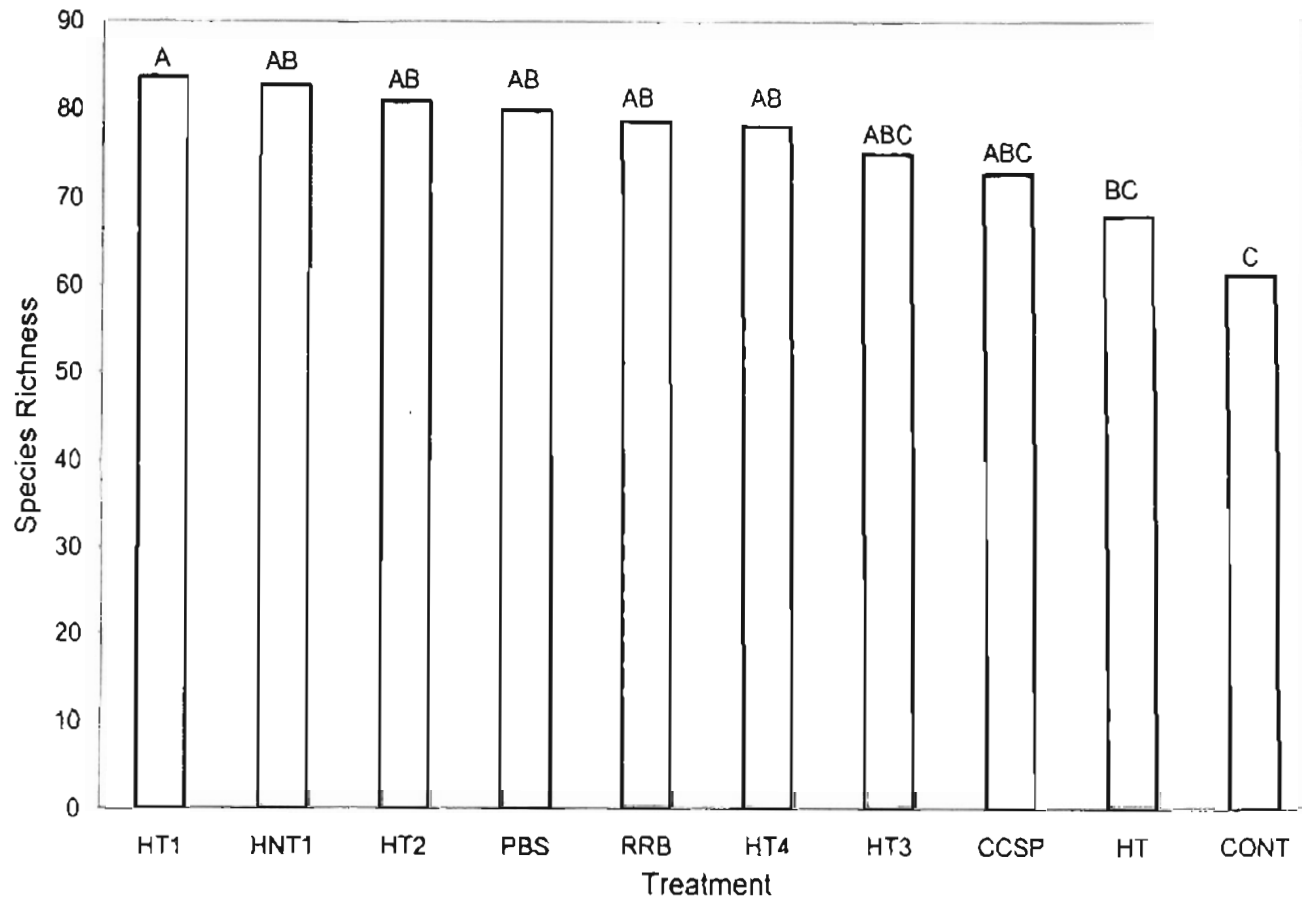


Figure 5. Species richness of understory plants in the Pushmataha Forest Habitat Research Area. Data are mean values for the experimental units at the 0.1 ha scale. Letters display the results of a LSD pairwise comparison ( $P \leq 0.05$ ). Means with different letters are significantly different. See Table 1 for the definition of each acronym.



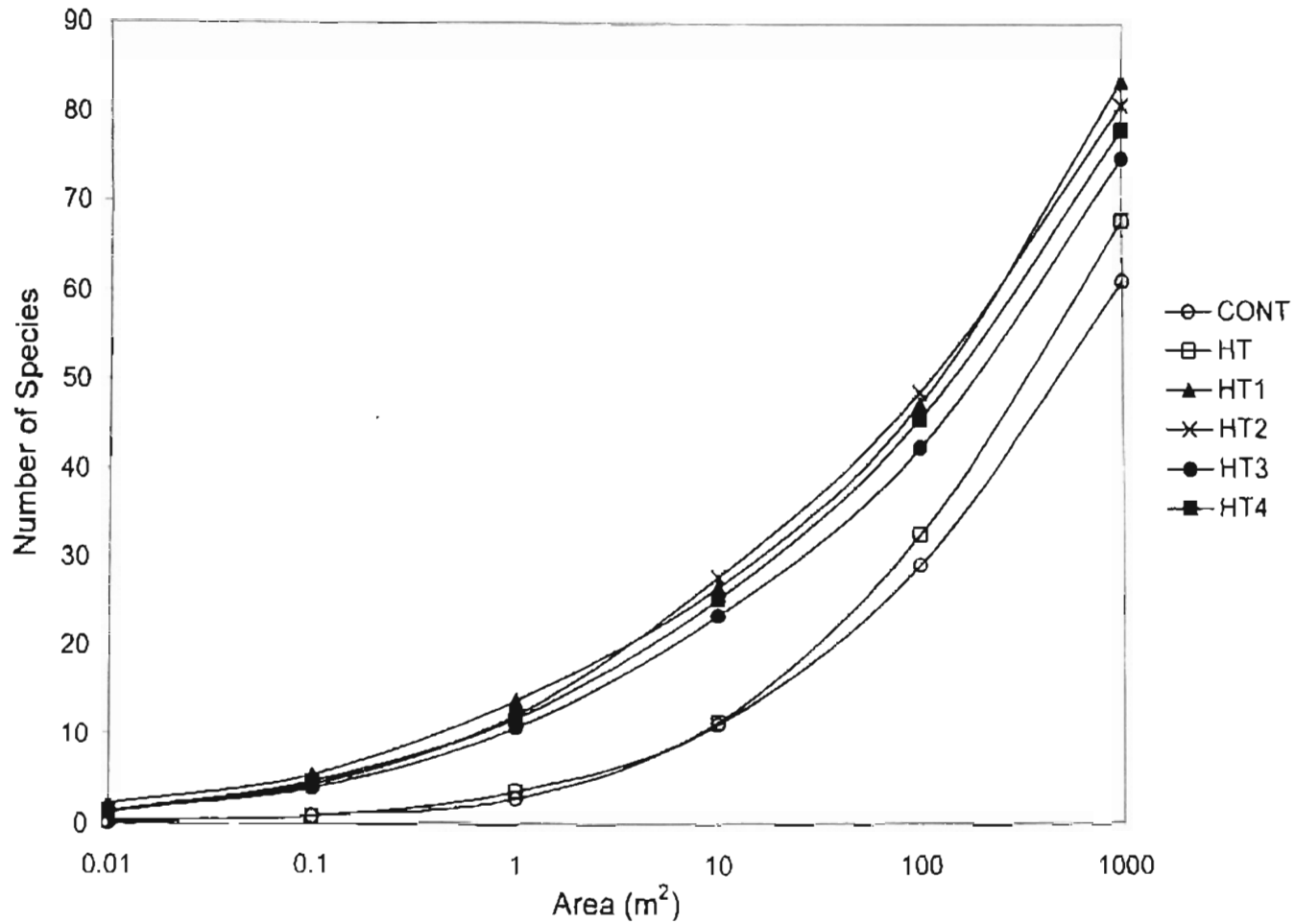


Figure 6. Species area curves for control and plots that had pines harvested and hardwoods thinned. Open symbols represent treatments that do not have a burn treatment. Area is on a log scale. See Table 1 for the definition of each acronym.

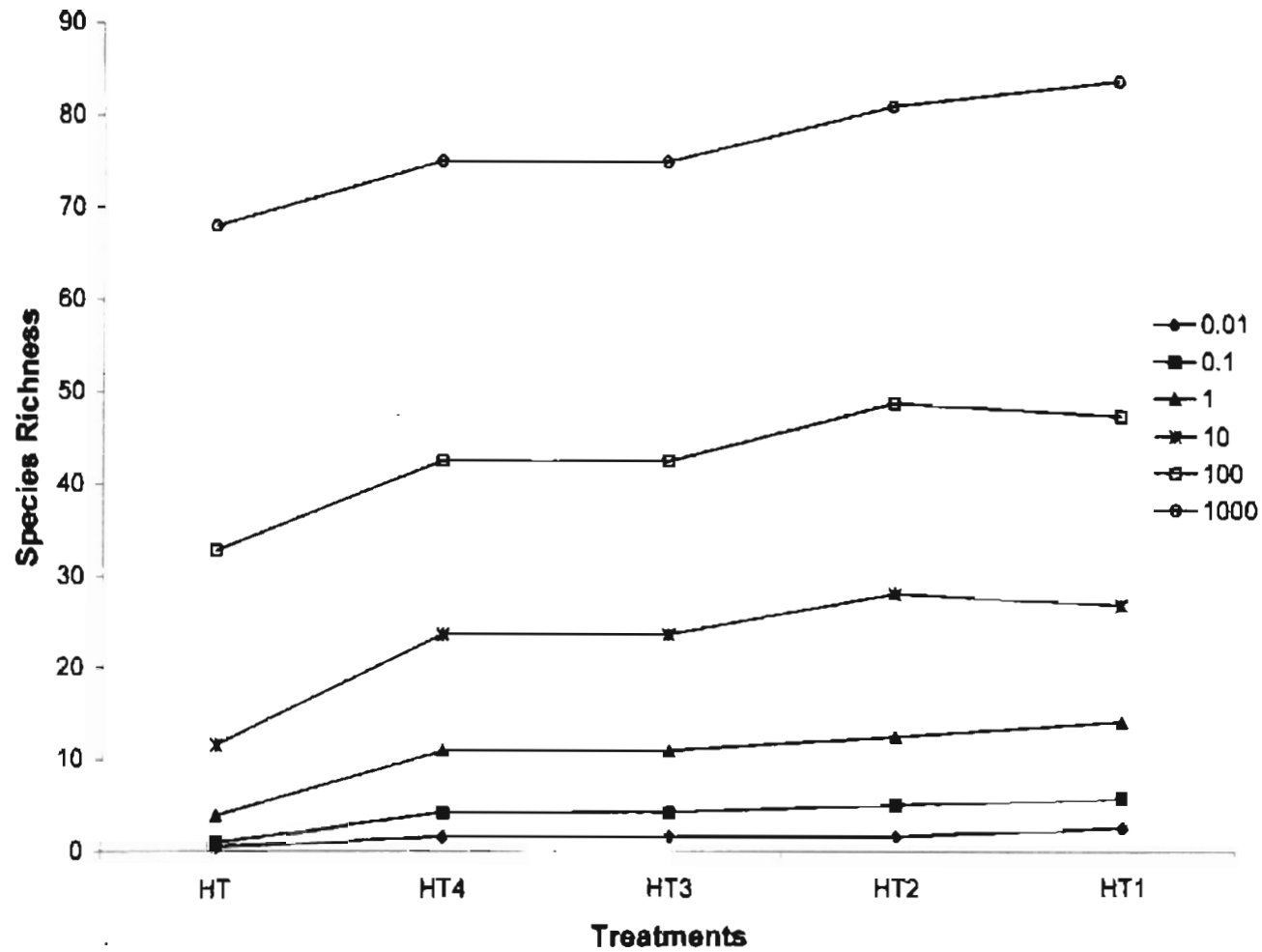


Figure 7. Species richness for plots that had pines harvested and hardwoods thinned. Each line represents a different spatial scale in units of meters squared. See Table 1 for the definition of each acronym.

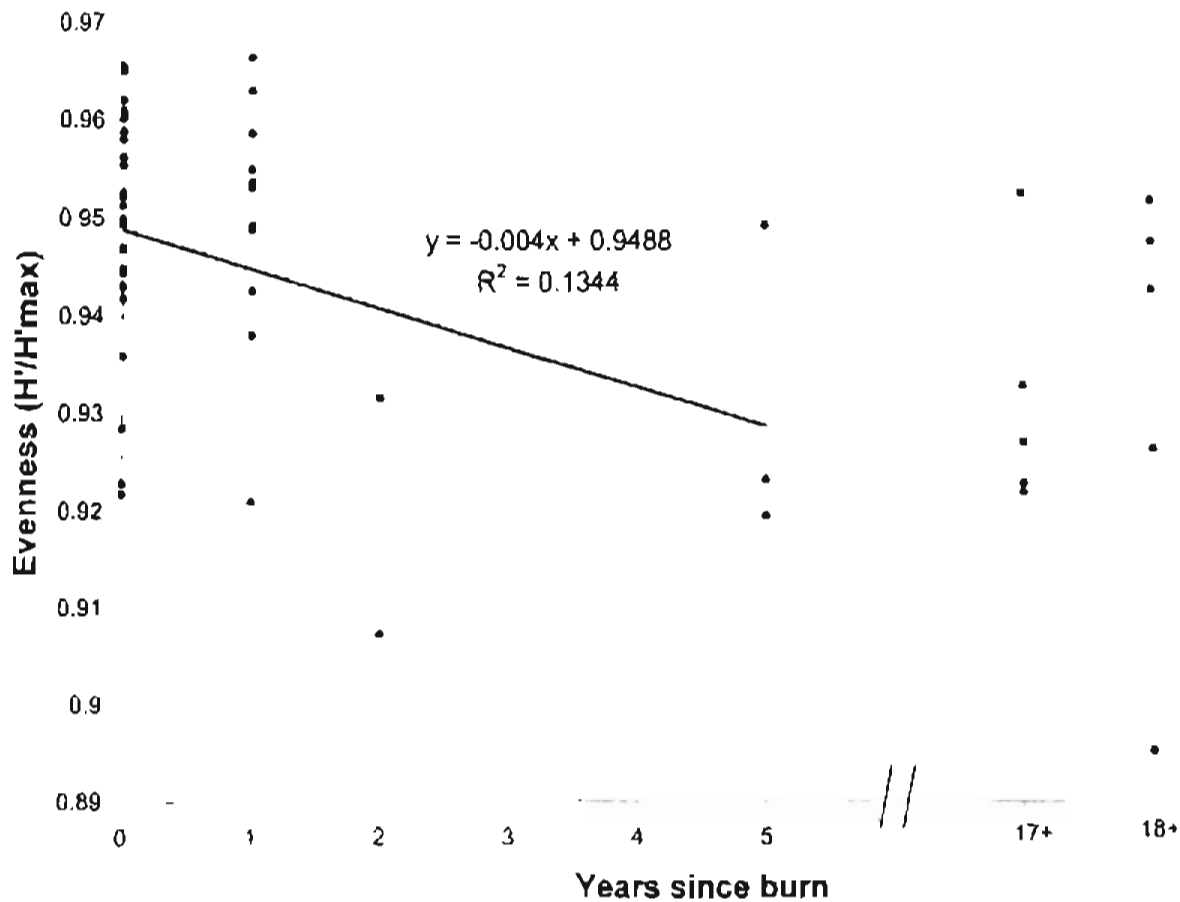


Figure 8. Evenness index ( $H'/H'max$ ) plotted as a function of years since burn. The CONT and HT treatments were excluded from regression analysis due to uncertainty about time since last burn. The line represents the results from a simple linear regression and has the equation: Estimated evenness =  $-0.004(\text{years since burn}) + 0.9488$ .

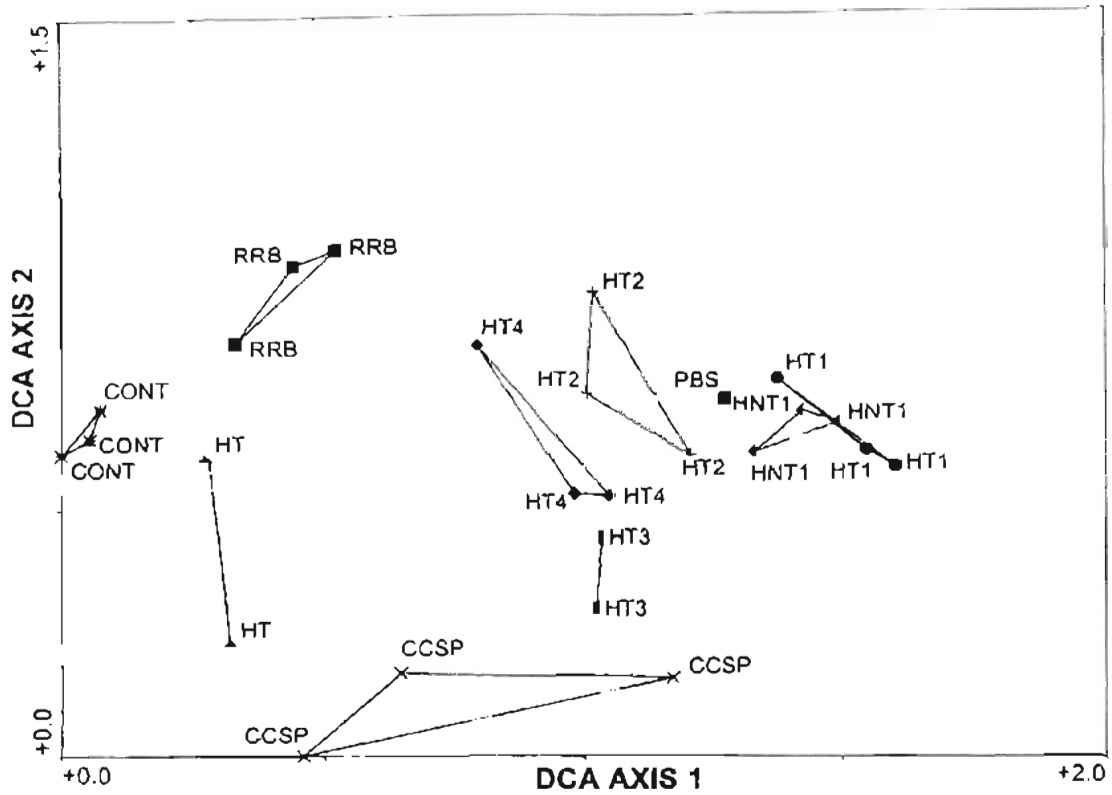


Figure 9. The first two axes of a DCA ordination of 26 plots based on average abundances of 224 understory plant species in the Pushmataha Forest Habitat Research Area. Envelopes or lines connect replicate plots in a treatment. See Table 1 for the definition of each acronym.

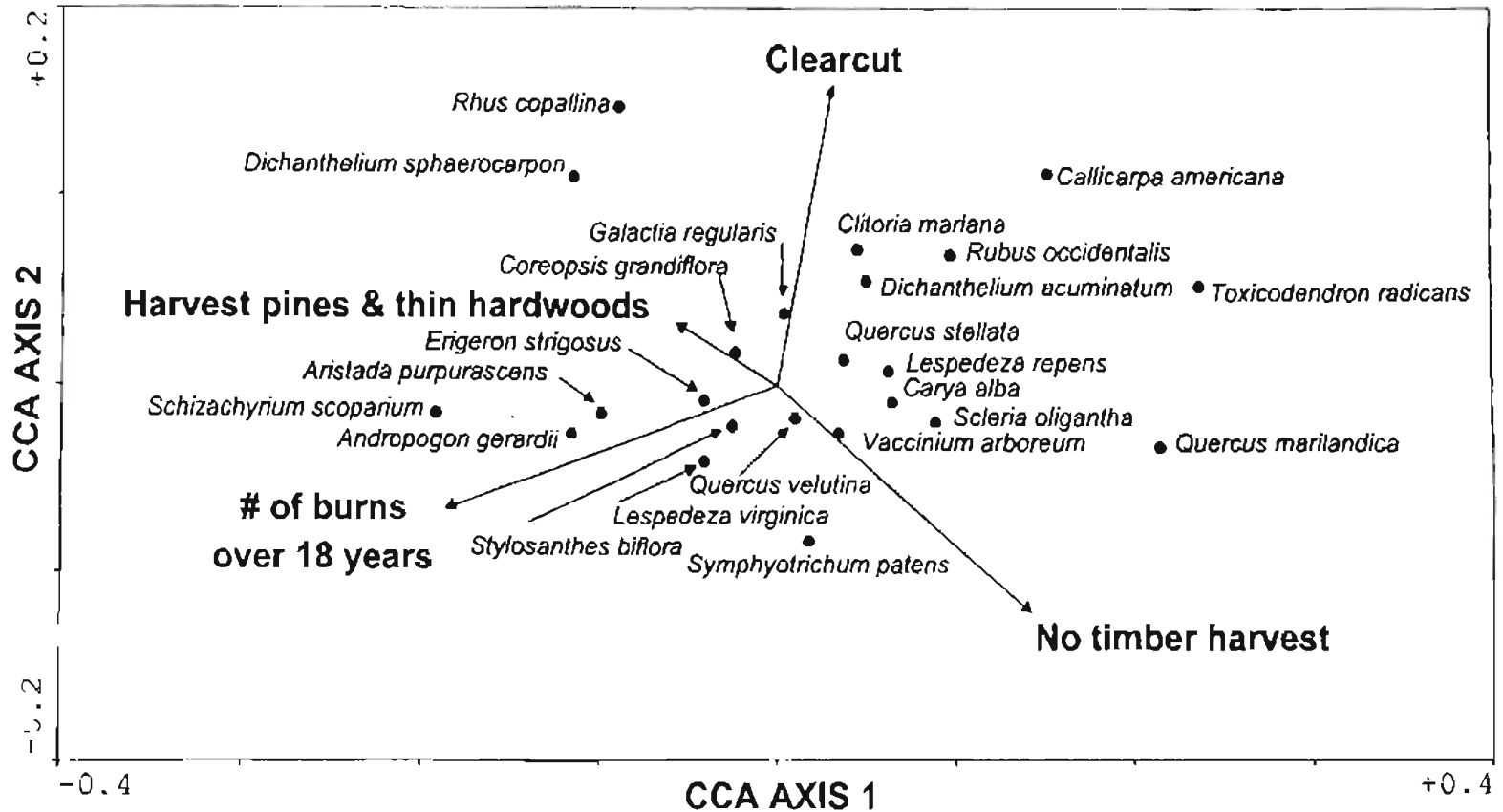


Figure 10. The first two axes of a CCA ordination of the Pushmataha Forest Habitat Research Area showing the relationship between herbaceous plant species abundance and environmental variables. Arrows represent environmental variables and circles represent the 22 most abundant species.

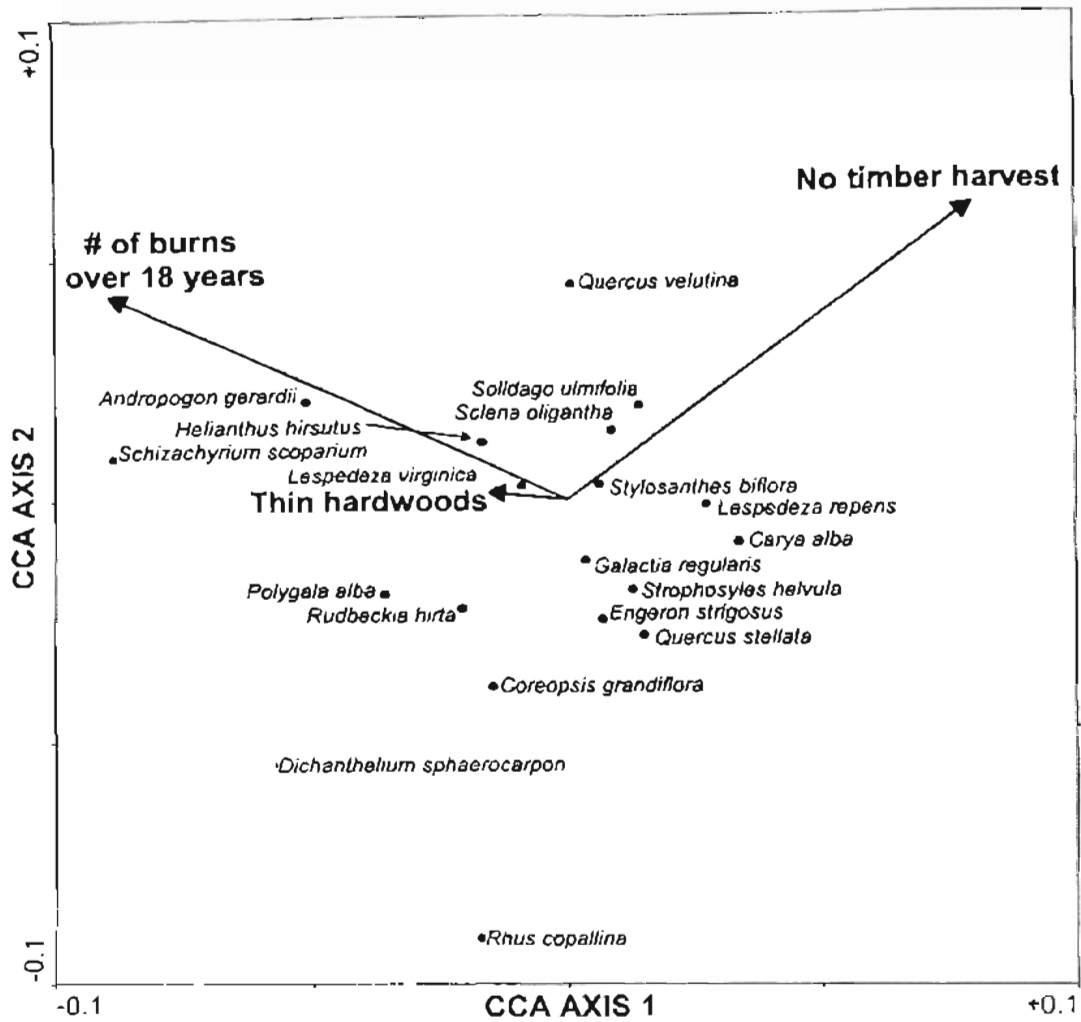


Figure 11. The first two axes of a CCA ordination of the Pushmataha Forest Habitat Research Area showing the relationship between herbaceous plant species abundance and environmental variables for treatment plots burned at 1 to 4-year intervals. Arrows represent variables and circles represent the 19 most abundant species.

APPENDIX A

SPECIES OF THE PWMA ARRANGED ALPHABETICALLY BY FAMILY WITH THEIR COMMON NAME, ABUNDANCE, AND NATIVITY (USDA, NRCS 1999). RELATIVE ABUNDANCE FOR IS BASED ON DENSITY OF POPULATIONS (PALMER ET AL., 1995)

Key to Symbols

A= Abundant  
 F= Frequent  
 O= Occasional  
 I= Infrequent  
 R= Rare  
 N= Native to North America  
 I= Introduced to North America  
 N/I= Origins debated

Family	Scientific Name	Common Name	Abundance	Nativity
Acanthaceae	<i>Justicia americana</i> (L.) Vahl	American water-willow	O	N
	<i>Justicia ovata</i> (Walt.) Lindau var. <i>lanceolata</i> (Chapman) R.W. Long	looseflower water-willow	R	N
	<i>Ruellia humilis</i> Nutt.	fringeleaf wild petunia	F	N
	<i>Ruellia pedunculata</i> Torr. ex Gray	stalked wild petunia	I	N
Aceraceae	<i>Acer rubrum</i> L.	red maple	F	N
Agavaceae	<i>Manfreda virginica</i> (L.) Salisb. ex Rose	false aloe	R	N
	<i>Yucca glauca</i> Nutt.	soapweed yucca	R	N
Alismataceae	<i>Alisma subcordatum</i> Raf.	American water plantain	I	N
	<i>Sagittaria graminea</i> Michx.	grassy arrowhead	R	N
Anacardiaceae	<i>Rhus aromatica</i> Ait.	fragrant sumac	I	N
	<i>Rhus copallina</i> L.*	flameleaf sumac	A	N
	<i>Rhus glabra</i> L.	smooth sumac	F	N
	<i>Toxicodendron radicans</i> (L.) Kuntze	eastern poison ivy	A	N
Apiaceae	<i>Ammoselinum poper</i> Torr. & Gray	plains sandparsley	I	N

	<i>Cicuta maculata</i> L.	spotted water hemlock	J	N
	<i>Cryptotaenia canadensis</i> (L.) DC.	Canadian honewort	I	N
	<i>Cynosciadium digitatum</i> DC.	finger dogshade	J	N
	<i>Daucus pusillus</i> Michx.	American wild carrot	A	N
	<i>Eryngium yuccifolium</i> Michx.	button eryngo	F	N
	<i>Polytaenia nuttallii</i> DC.	Nuttall's prairie parsley	I	N
	<i>Ptilimnium nuttallii</i> (DC.) Britt.	laceflower	F	N
	<i>Sanicula canadensis</i> L.	Canadian blacksnakeroot	O	N
	<i>Spernolepis divaricata</i> (Walt.) Raf. ex Ser.	roughfruit scaleseed	I	N
	<i>Thaspium trifoliatum</i> (L.) Gray	purple meadowparsnip	O	N
	<i>Torilis arvensis</i> (Huds.) Link	spreading hedgeparsley	I	I
	<i>Zizia aurea</i> (L.) W.D.J. Koch	golden zizia	I	N
Aquifoliaceae	<i>Ilex decidua</i> Walt.	possumhaw	R	N
	<i>Ilex opaca</i> Ait.	American holly	R	N
Araceae	<i>Arisaema dracontium</i> (L.) Schott	green dragon	R	N
Asclepiadaceae	<i>Asclepias hirtella</i> (Pennell) Woods.	green milkweed	F	N
	<i>Asclepias tuberosa</i> L.	butterfly milkweed	F	N
	<i>Asclepias variegata</i> L.	redring milkweed	F	N
	<i>Asclepias verticillata</i> L.	whorled milkweed	F	N
	<i>Asclepias viridis</i> Walt.	green antelopehorn	F	N
	<i>Cynanchum laeve</i> (Michx.) Pers.	honeyvine	R	N
Aspleniaceae	<i>Asplenium platyneuron</i> (L.) B.S.P.	ebony spleenwort	O	N
Asteraceae	<i>Achillea millefolium</i> L.	common yarrow	F	N/I
	<i>Ambrosia artemisiifolia</i> L.	annual ragweed	O	N
	<i>Ambrosia bidentata</i> Michx.	lanceleaf ragweed	O	N
	<i>Antennaria parlinii</i> Fern.	Parlin's pussytoes	F	N
	<i>Arnoglossum plantagineum</i> Raf.	groovestem Indian plantain	O	N



<i>Astranthium integrifolium</i> (Michx.) Nutt	entireleaf western daisy	I	N
<i>Bidens aristosa</i> (Michx.) Britt.	bearded beggarticks	I	N
<i>Bidens bipinnata</i> L.	Spanish needles	R	N
<i>Boltoma diffusa</i> Ell.	smallhead doll's daisy	O	N
<i>Chaetopappa asteroides</i> Nutt. ex DC.	Arkansas leasdaisy	O	N
<i>Cirsium altissimum</i> (L.) Hill	tall thistle	O	N
<i>Cirsium carolinianum</i> (Walt.) Fern. & Schub.	soft thistle	O	N
<i>Conoclinium coelestinum</i> (L.) DC.	blue mistflower	I	N
<i>Conyza canadensis</i> (L.) Cronq.	Canadian horseweed	O	N
<i>Coreopsis grandiflora</i> Hogg ex Sweet	largeflower tickseed	A	N
<i>Coreopsis palmata</i> Nutt.	stiff tickseed	F	N
<i>Coreopsis tinctoria</i> Nutt.	golden tickseed	A	N
<i>Coreopsis tripteris</i> L.	tall tickseed	I	N
<i>Echinacea pallida</i> (Nutt.) Nutt.	pale purple coneflower	O	N
<i>Elephantopus carolinianus</i> Ræusch.	Carolina elephantsfoot	I	N
<i>Erechtites hieracifolia</i> (L.) Raf. ex DC.	American burnweed	I	N
<i>Erigeron annuus</i> (L.) Pers.	eastern daisy fleabane	I	N
<i>Erigeron strigosus</i> Muhl. ex Willd.	prairie fleabane	A	N
<i>Eupatorium capillifolium</i> (Lam.) Small	dogfennel	I	N
<i>Eupatorium perfoliatum</i> L.	common boneset	F	N
<i>Eupatorium serotinum</i> Michx.	lateflowering thoroughwort	O	N
<i>Eurybia paludosa</i> (Ait.) Nesom	southern swamp aster	F	N
<i>Fleischmannia incornata</i> (Walt.) King & H.E. Robins.	pink thoroughwort	I	N
<i>Gaillardia aestivalis</i> (Walt.) H. Rock	lanceleaf blanketflower	R	N
<i>Gamochaeta purpurea</i> (L.) Cabrera	spoonleaf purple everlasting	I	N
<i>Helianthus amarum</i> (Raf.) H. Rock	yellowdicks	F	N
<i>Helianthus autumnale</i> L.	common sneezeweed	F	N

<i>Helenium flexuosum</i> Raf.	purplehead sneezeweed	O	N
<i>Helianthus angustifolius</i> L.	swamp sunflower	I	N
<i>Helianthus hirsutus</i> Raf	hairy sunflower	A	N
<i>Helianthus mollis</i> Lam.	ashy sunflower	O	N
<i>Heterotheca villosa</i> (Pursh) Shinnery	hairy false goldenaster	F	N
<i>Hieracium gronovii</i> L.	queendevil	O	N
<i>Hymenopappus scabiosaenus</i> L'Hér.	Carolina woollywhite	I	N
<i>Krigia dandelion</i> (L.) Nutt.	potato dwarf dandelion	O	N
<i>Krigia virginica</i> (L.) Willd.	Virginia dwarf dandelion	O	N
<i>Liatris elegans</i> (Walt.) Michx.	pinkscale blazing star	O	N
<i>Liatris pycnostachya</i> Michx.	prairie blazing star	F	N
<i>Liatris squarrosa</i> (L.) Michx.	scaly blazing star	O	N
<i>Liatris squarrosula</i> Michx.	Appalachian blazing star	O	N
<i>Marshallia caespitosa</i> Nutt. ex DC.	puffballs	R	N
<i>Packera aurea</i> (L.) A. & D. Löve	golden ragwort	A	N
<i>Parthenium integrifolium</i> L.	wild quinine	O	N
<i>Pityopsis graminifolia</i> (Michx.) Nutt.	narrowleaf silkgrass	F	N
<i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & Burt	rabbittobacco	O	N
<i>Pyrrhopappus carolinianus</i> (Walt.) DC.	Carolina desert-chicory	O	N
<i>Pyrrhopappus grandiflorus</i> (Nutt.) Nutt.	tuberous desert-chicory	O	N
<i>Rudbeckia grandiflora</i> (D. Don) J.F. Gmel. ex DC.	rough coneflower	R	N
<i>Rudbeckia hirta</i> L.	blackeyed Susan	A	N
<i>Silphium laciniatum</i> L.	compassplant	I	N
<i>Solidago nemoralis</i> Ait	gray goldenrod	I	N
<i>Solidago petiolaris</i> Ait.	downy ragged goldenrod	I	N
<i>Solidago radula</i> Nutt.	western rough goldenrod	I	N
<i>Solidago ulmifolia</i> Muhl. ex Willd.	elmleaf goldenrod	A	N

	<i>Symphotrichum lateriflorum</i> (L.) A.& D. Löve	calico aster	O	N
	<i>Symphotrichum patens</i> (Ait.) Nesom	late purple aster	F	N
	<i>Verbesina helianthoides</i> Michx.	gravelweed	I	N
	<i>Verbesina virginica</i> L.	white crownbeard	I	N
	<i>Vernonia baldwinii</i> Torr.	Baldwin's ironweed	A	N
	<i>Vernonia lettermannii</i> Engelm. ex Gray	narrowleaf ironweed	R	N
Balsaminaceae	<i>Impatiens capensis</i> Meerb.	jewelweed	R	N
Berberidaceae	<i>Podophyllum peltatum</i> L.	mayapple	I	N
Betulaceae	<i>Alnus serrulata</i> (Ait.) Willd.	hazel alder	F	N
	<i>Betula nigra</i> L.	river birch	F	N
	<i>Carpinus caroliniana</i> Walt.	American hornbeam	R	N
	<i>Ostrya virginiana</i> (P. Mill.) K. Koch	hophornbeam	F	N
Bignoniaceae	<i>Campsis radicans</i> (L.) Seem. ex Bureau	trumpet creeper	I	N
	<i>Catalpa bignonioides</i> Walt.	southern catalpa	I	N
Boraginaceae	<i>Myosotis verna</i> Nutt.	spring forget-me-not	R	N
Brassicaceae	<i>Cardamine purviflora</i> L.	sand bittercress	F	N
	<i>Lepidium virginicum</i> L.	Virginia pepperweed	O	N
Buddlejaceae	<i>Polypremum procumbens</i> L.	juniper leaf	R	N
Cactaceae	<i>Opuntia macrorhiza</i> Engelm.	twistspine pricklypear	R	N
Campanulaceae	<i>Lobelia cardinalis</i> L.	cardinalflower	R	N
	<i>Lobelia puberula</i> Michx.	downy lobelia	I	N
	<i>Lobelia spicata</i> Lam.	palespike lobelia	F	N
	<i>Triodanis perfoliata</i> (L.) Nieuwl.	clasping Venus' looking-glass	O	N
Caprifoliaceae	<i>Sambucus nigra</i> L.	European black elderberry	R	N/I
	<i>Symphoricarpos orbiculatus</i> Moench	coralberry	F	N
	<i>Viburnum rufidulum</i> Raf.	rusty blackhaw	R	N

Caryophyllaceae	<i>Minuartia drummondii</i> (Shinners) McNeill	Drummond's stitchwort	F	N
	<i>Minuartia patula</i> (Michx.) Mattf.	pitcher's stitchwort	A	N
	<i>Silene stellata</i> (L.) Ait. f.	widowsfrill	I	N
	<i>Stellaria media</i> (L.) Vill.	common chickweed	F	I
Celastraceae	<i>Euonymus americana</i> L.	strawberry bush	R	N
Cistaceae	<i>Lechea tenuifolia</i> Michx.	narrowleaf pinweed	A	N
Clusiaceae	<i>Hypericum densiflorum</i> Pursh	bushy St. Johnswort	I	N
	<i>Hypericum drummondii</i> (Grev. & Hook.) Torr. & Gray	nits and lice	I	N
	<i>Hypericum hypericoides</i> (L.) Crantz	St. Andrew's cross	O	N
	<i>Hypericum mutllum</i> L.	dwarf St. Johnswort	I	N
	<i>Hypericum punctatum</i> Lam	spotted St. Johnswort	R	N
Commelinaceae	<i>Commelina erecta</i> L.	whitemouth dayflower	R	N
	<i>Commelina virginica</i> L.	Virginia dayflower	O	N
	<i>Tradescantia ohimensis</i> Raf.	bluejacket	F	N
Convolvulaceae	<i>Ipomoea lacunosa</i> L.	whitestar	O	N
	<i>Ipomoea pandurata</i> (L.) G.F.W. Mey.	man of the earth	R	N
Cornaceae	<i>Cornus obliqua</i> Raf.	silky dogwood	R	N
	<i>Cornus florida</i> L.	flowering dogwood	R	N
Crassulaceae	<i>Penthorum sedoides</i> L.	ditch stonecrop	R	N
Cupressaceae	<i>Juniperus virginiana</i> L.	eastern redcedar	F	N
Cuscutaceae	<i>Cuscuta indecora</i> Choisy	bigseed alfalfa dodder	F	N
	<i>Cuscuta pentagona</i> Engelm.	fiveangled dodder	F	N
Cyperaceae	<i>Carex amphibola</i> Steud.	eastern narrowleaf sedge	O	N
	<i>Carex aureolensis</i> Steud.**	No common name	O	N
	<i>Carex blanda</i> Dewey	eastern woodland sedge	O	N
	<i>Carex bushii</i> Mackenzie	Bush's sedge	F	N
	<i>Carex crinita</i> Lam.	fringed sedge	O	N

	<i>Carex granularis</i> Muhl. ex. Willd.	limestone meadow sedge	O	N
	<i>Carex leavenworthii</i> Dewey	Leavenworth's sedge	O	N
	<i>Carex lupuliformis</i> Sartwell ex Dewey	false hop sedge	R	N
	<i>Carex meadii</i> Dewey	Mead's sedge	A	N
	<i>Carex oklahomensis</i> Mackenzie	Oklahoma sedge	R	N
	<i>Carex oxylepis</i> Torr. & Hook.	sharpscale sedge	R	N
	<i>Carex reniformis</i> (Bailey) Small	kidneyshape sedge	O	N
	<i>Carex scoparia</i> Schkuhr ex Willd.	broom sedge	R	N
	<i>Carex socialis</i> Mohlenbrock & Schwegm.	low woodland sedge	I	N
	<i>Carex texensis</i> (Torr.) Bailey	Texas sedge	I	N
	<i>Cyperus echinatus</i> (L.) Wood	globe flatsedge	F	N
	<i>Cyperus esculentus</i> L.	chufa flatsedge	O	N/I
	<i>Cyperus lupulinus</i> (Spreng.) Marcks	Great Plains flatsedge	O	N
	<i>Dulichium arundinaceum</i> (L.) Britt.	threeway sedge	R	N
	<i>Eleocharis quadrangulata</i> (Michx.) Roemer & J.A. Schultes	squarestem spikerush	R	N
	<i>Eleocharis rostellata</i> (Torr.) Torr.	beaked spikerush	R	N
	<i>Eleocharis tenuis</i> (Willd.) J.A. Schultes	slender spikerush	F	N
	<i>Fimbristylis puberula</i> (Michx.) Vahl	hairy fimbr	O	N
	<i>Isolepis carinata</i> Hook. & Arn. ex Torr.	keeled bulrush	R	N
	<i>Rhynchospora corniculata</i> (Lam.) Gray	shortbristle horned beaksedge	R	N
	<i>Rhynchospora harveyi</i> W. Boott	Harvey's beaksedge	I	N
	<i>Scleria oligantha</i> Michx.	littlehead nutrush	A	N
Dennstaedtiaceae	<i>Pteridium aquilinum</i> (L.) Kuhn	western brackenfern	I	N
Dioscoreaceae	<i>Dioscorea quaternata</i> J.F. Gimel.	fourleaf yam	R	N
Dryopteridaceae	<i>Polystichum acrostichoides</i> (Michx.) Schott	Christmas fern	F	N
	<i>Woodsia obtusa</i> (Spreng.) Torr.	bluntlobe cliff fern	F	N

Ebenaceae	<i>Diospyros virginiana</i> L.	common persimmon	R	N
Elaeagnaceae	<i>Elaeagnus angustifolia</i> L.	Russian olive	F	I
	<i>Elaeagnus umbellata</i> Thunb.	autumn olive	F	I
Ericaceae	<i>Vaccinium arboreum</i> Marsh.	huckleberry	F	N
	<i>Vaccinium stamineum</i> L.	deerberry	O	N
Euphorbiaceae	<i>Acalypha gracilens</i> Gray	slender threeseed mercury	A	N
	<i>Acalypha virginica</i> L.	Virginia threeseed mercury	R	N
	<i>Chamaesyce nutans</i> (Lag.) Small	eyebane	O	N
	<i>Croton capitatus</i> Michx.	hogwort	F	N
	<i>Croton glandulosus</i> L.	vente conmigo	I	N
	<i>Croton monanthogynus</i> Michx.	prairie tea	A	N
	<i>Croton willdenowii</i> G.L. Webster	Willdenow's croton	O	N
	<i>Euphorbia heterophylla</i> L.	Mexican fireplant	R	N
	<i>Euphorbia tetrapora</i> Engelm.	weak spurge	R	N
	<i>Tragia betonicifolia</i> Nutt.	betony leaf noseburn	R	N
	Fabaceae	<i>Albizia julibrissin</i> Durazz.	silk tree	I
<i>Amorpha laevigata</i> Nutt.		smooth false indigo	R	N
<i>Amphicarpaea bracteata</i> (L.) Fern.		American hogpeanut	F	N
<i>Baptisia bracteata</i> Muhl. ex Ell.		longbract wild indigo	F	N
<i>Cercis canadensis</i> L.		eastern redbud	O	N
<i>Chamaecrista fasciculata</i> (Michx.) Greene		sleeping plant	A	N
<i>Cytisium mariana</i> L.		Atlantic pigeonwings	A	N
<i>Crotalaria sagittalis</i> L.		arrowhead rattlebox	F	N
<i>Desmodium canadense</i> (L.) DC.		showy ticktrefoil	F	N
<i>Desmodium canescens</i> (L.) DC.		hoary ticktrefoil	R	N
<i>Desmodium ciliare</i> (Muhl. ex Willd.) DC.		hairy small-leaf ticktrefoil	F	N
<i>Desmodium paniculatum</i> (L.) DC.	panicked leaf ticktrefoil	F	N	

	<i>Desmodium pauciflorum</i> (Nutt.) DC.	fewflower ticktrefoil	F	N
	<i>Desmodium sessilifolium</i> (Torr.) Torr. & Gray	sessileleaf ticktrefoil	F	N
	<i>Desmodium viridiflorum</i> (L.) DC.	velvetleaf ticktrefoil	F	N
	<i>Galactia regularis</i> (L.) B.S.P.	eastern milkpea	A	N
	<i>Gleditsia triucanthos</i> L.	honeylocust	O	N
	<i>Kummerowia striata</i> (Thunb.) Schindl.	Japanese clover	I	I
	<i>Lespedeza cuneata</i> (Dum.-Cours.) G. Don	Chinese lespedeza	A	I
	<i>Lespedeza hirta</i> (L.) Hornem.	hairy lespedeza	F	N
	<i>Lespedeza procumbens</i> Michx.	trailing lespedeza	I	N
	<i>Lespedeza repens</i> (L.) W. Bart.	creeping lespedeza	A	N
	<i>Lespedeza stuevei</i> Nutt.	tall lespedeza	F	N
	<i>Lespedeza virginica</i> (L.) Britt.	slender lespedeza	A	N
	<i>Medicago lupulina</i> L.	black medick	F	I
	<i>Mimosa quadrivalvis</i> L.	fourvalve mimosa	A	N
	<i>Psoralidium tenuiflorum</i> (Pursh) Rydb.	slimflower scurfpea	A	N
	<i>Rhynchosia latifolia</i> Nutt. ex Torr. & Gray	prairie snoutbean	I	N
	<i>Robinia pseudoacacia</i> L.	black locust	I	N
	<i>Strophostyles helvula</i> (L.) Ell.	trailing fuzzybean	A	N
	<i>Strophostyles umbellata</i> (Muhl. ex Willd.) Britt.	pink fuzzybean	A	N
	<i>Stylosanthes biflora</i> (L.) B.S.P.	sidebeak pencilflower	A	N
	<i>Tephrosia virginiana</i> (L.) Pers.	Virginia tephrosia	A	N
	<i>Trifolium pratense</i> L.	red clover	O	I
	<i>Vicia sativa</i> L.	garden vetch	O	I
	<i>Vicia villosa</i> Roth	winter vetch	A	I
Fagaceae	<i>Quercus alba</i> L.	white oak	R	N
	<i>Quercus marilandica</i> Muenchh.	blackjack oak	A	N
	<i>Quercus nigra</i> L.	water oak	R	N

	<i>Quercus stellata</i> Wangenh.	post oak	A	N
	<i>Quercus velutina</i> Lam.	black oak	A	N
Fumariaceae	<i>Corydalis crystallina</i> Engelm.	mealy fumewort	O	N
Gentianaceae	<i>Sabatia campestris</i> Nutt.	Texas star	I	N
Geraniaceae	<i>Geranium carolinianum</i> L.	Carolina geranium	I	N
Grossulariaceae	<i>Ribes cynosbati</i> L.	eastern prickly gooseberry	R	N
Hamamelidaceae	<i>Liquidambar styraciflua</i> L.	sweetgum	F	N
Hydrophyllaceae	<i>Hydrolea ovata</i> Nutt. ex Choisy	ovate false fiddleleaf	O	N
	<i>Nemophila phacelioides</i> Nutt.	largeflower baby blue eyes	R	N
Iridaceae	<i>Sisyrinchium angustifolium</i> P. Mill.	narrowleaf blue-eyed grass	F	N
	<i>Hypoxis hirsuta</i> (L.) Coville	common goldstar	A	N
Juglandaceae	<i>Carya alba</i> (L.) Nutt. ex Ell.	mockernut hickory	A	N
	<i>Carya cordiformis</i> (Wangenh.) K. Koch	bitternut hickory	I	N
	<i>Carya texana</i> Buckl.	black hickory	A	N
	<i>Juglans nigra</i> L.	black walnut	R	N
Juncaceae	<i>Juncus acuminatus</i> Michx.	tapertip rush	I	N
	<i>Juncus balticus</i> Willd.	Baltic rush	R	N
	<i>Juncus brachycarpus</i> Engelm.	whiteroot rush	I	N
	<i>Juncus coriaceus</i> Mackenzie	leathery rush	I	N
	<i>Juncus diffusissimus</i> Buckl.	slimpod rush	I	N
	<i>Juncus effusus</i> L.	common rush	A	N
	<i>Juncus marginatus</i> Rostk.	grassleaf rush	I	N
	<i>Juncus secundus</i> Beauv. ex Poir.	lopsided rush	I	N
	<i>Juncus tenuis</i> Willd.	poverty rush	F	N
Lamiaceae	<i>Cunila organoides</i> (L.) Britt.	common dittany	I	N
	<i>Lycopus virginicus</i> L.	Virginia water horchound	I	N
	<i>Monarda fistulosa</i> L.	wild bergamot	I	N



	<i>Monarda russeliana</i> Nutt. ex Sims	redpurple beebalm	A	N
	<i>Perilla frutescens</i> (L.) Brit.	beefsteakplant	I	I
	<i>Primella vulgaris</i> L.	common selfical	O	N
	<i>Pycnanthemum albescens</i> Torr. & Gray	whiteleaf mountainmint	R	N
	<i>Pycnanthemum tenuifolium</i> Schrad.	narrowleaf mountainmint	O	N
	<i>Salvia azurea</i> Michx. ex Lam.	azure blue sage	R	N
	<i>Salvia lyrata</i> L.	lyreleaf sage	I	N
	<i>Scutellaria elliptica</i> Muhl. ex Spreng.	hairy skullcap	R	N
	<i>Scutellaria ovata</i> Hill	heartleaf skullcap	A	N
	<i>Teucrium canadense</i> L.	Canada germander	O	N
	<i>Trichostema dichotomum</i> L.	forked bluecurls	I	N
Lauraceae	<i>Lindera benzoin</i> (L.) Blume	northern spicebush	R	N
	<i>Sassafras albidum</i> (Nutt.) Nees	sassafras	R	N
Liliaceae	<i>Allium canadense</i> L.	meadow garlic	A	N
	<i>Allium stellatum</i> Nutt. ex Ker-Gawl.	autumn onion	F	N
	<i>Camassia scilloides</i> (Raf.) Cory	Atlantic camas	R	N
	<i>Nothoscordum bivalve</i> (L.) Britt.	crowpoison	A	N
Malvaceae	<i>Callirhoe digitata</i> Nutt.	winecup	R	N
Melastomataceae	<i>Rhexia mariana</i> L.	Maryland meadowbeauty	I	N
Moraceae	<i>Morus rubra</i> L.	red mulberry	I	N
Nymphaeaceae	<i>Nuphar lutea</i> (L.) Sm.	yellow pond-lily	I	N
Nyssaceae	<i>Nyssa sylvatica</i> Marsh	blackgum	O	N
Oleaceae	<i>Fraxinus americana</i> L.	white ash	O	N
	<i>Fraxinus pennsylvanica</i> Marsh.	green ash	O	N
	<i>Ligustrum sinense</i> Lour.	Chinese privet	O	I
Onagraceae	<i>Ludwigia alternifolia</i> L.	seedbox	O	N
	<i>Oenothera fruticosa</i> L.	narrowleaf evening-primrose	F	N

	<i>Oenothera laciniata</i> Hill	cutleaf evening-primrose	O	N
	<i>Oenothera linifolia</i> Nutt.	threadleaf evening-primrose	F	N
Ophioglossaceae	<i>Botrychium virginianum</i> (L.) Sw.	rattlesnake fern	R	N
Orchidaceae	<i>Spiranthes cernua</i> (L.) L.C. Rich.	nodding ladies'-tresses	R	N
Oxalidaceae	<i>Oxalis stricta</i> L.	common yellow oxalis	A	N
	<i>Oxalis violacea</i> L.	violet woodsorrel	A	N
Passifloraceae	<i>Passiflora incarnata</i> L.	purple passionflower	R	N
	<i>Passiflora lutea</i> L.	yellow passionflower	R	N
Phytolaccaceae	<i>Phytolacca americana</i> L.	American pokeweed	O	N
Pinaceae	<i>Pinus echinata</i> P. Mill.	shortleaf pine	A	N
	<i>Pinus taeda</i> L.	loblolly pine	O	N
Plantaginaceae	<i>Plantago aristata</i> Michx.	largebracted plantain	O	N
	<i>Plantago major</i> L.	common plantain	R	N
	<i>Plantago virginica</i> L.	Virginia plantain	O	N
Platanaceae	<i>Platanus occidentalis</i> L.	American sycamore	I	N
Poaceae	<i>Agrostis exarata</i> Trin.	spike bentgrass	I	N
	<i>Agrostis hyemalis</i> (Walt.) B.S.P.	winter bentgrass	F	N
	<i>Andropogon gerardii</i> Vitman	big bluestem	A	N
	<i>Andropogon gyrans</i> Ashe	Elliott's bluestem	R	N
	<i>Anthoxanthum aristatum</i> Boiss.	annual vernalgrass	F	I
	<i>Aristida dichotoma</i> Michx.	churchmouse threeawn	I	N
	<i>Aristida oligantha</i> Michx.	prairie threeawn	I	N
	<i>Aristida purpurascens</i> Poir.	arrowfeather threeawn	A	N
	<i>Arundinaria gigantea</i> (Walt.) Muhl.	giant cane	R	N
	<i>Bothriochloa laguroides</i> (DC.) Herter	silver beardgrass	R	N
	<i>Brachyelytrum erectum</i> (Schreb. ex Spreng.) Beauv.	bearded shorthusk	R	N
	<i>Bromus hordeaceus</i> L.	soft brome	I	I

<i>Bromus pubescens</i> Muhl. ex Willd.	hairy woodland brome	O	N
<i>Bromus secalinus</i> L.	rye brome	I	I
<i>Calamovilfa arcuata</i> K.E. Rogers	Cumberland sandreed	R	N
<i>Chasmanthium latifolium</i> (Michx.) Yates	Indian woodoats	A	N
<i>Chasmanthium laxum</i> (L.) Yates	slender woodoats	I	N
<i>Coelorachis cylindrica</i> (Michx.) Nash	cylinder jointtail grass	F	N
<i>Dactylis glomerata</i> L.	orchardgrass	O	I
<i>Danthonia spicata</i> (L.) Beauv. ex Roemer & J.A. Schultes	poverty oatgrass	A	N
<i>Dichantheium acuminatum</i> (Sw.) Gould & C.A. Clark	tapered rosette grass	A	N
<i>Dichantheium boscii</i> (Poir.) Gould & C.A. Clark	Bosc's panicgrass	I	N
<i>Dichantheium depauperatum</i> (Muhl.) Gould	starved panicgrass	A	N
<i>Dichantheium dichotomum</i> (L.) Gould	cypress panicgrass	F	N
<i>Dichantheium luxiflorum</i> (Lam.) Gould	openflower rosette grass	I	N
<i>Dichantheium oligosanthos</i> (J.A. Schultes) Gould	Heller's rosette grass	I	N
<i>Dichantheium scoparium</i> (Lam.) Gould	velvet panicum	I	N
<i>Dichantheium sphaerocarpon</i> (Ell.) Gould	roundseed panicgrass	A	N
<i>Digitaria ischaemum</i> (Schreb.) Schreb. ex Muhl.	smooth crabgrass	I	I
<i>Digitaria sanguinalis</i> (L.) Scop.	hairy crabgrass	I	N
<i>Echinochloa crus-galli</i> (L.) Beauv.	barnyardgrass	O	I
<i>Elymus canadensis</i> L.	Canada wildrye	F	N
<i>Elymus virginicus</i> L.	Virginia wildrye	F	N
<i>Eragrostis hirsuta</i> (Michx.) Nees	bigtop lovegrass	I	N
<i>Eragrostis pilosa</i> (L.) Beauv.	Indian lovegrass	I	N
<i>Festuca paradoxa</i> Desv.	clustered fescue	O	N
<i>Festuca subverticillata</i> (Pers.) Alexeev	nodding fescue	O	N
<i>Gymnopogon ambiguus</i> (Michx.) B.S.P	bearded skeletongrass	A	N

<i>Hordeum pusillum</i> Nutt.	little barley	O	N
<i>Leersia oryzoides</i> (L.) Sw.	rice cutgrass	R	N
<i>Lolium arundinaceum</i> (Schreb.) S.J. Darbyshire	tall fescue	O	I
<i>Lolium perenne</i> L.	perennial ryegrass	O	I
<i>Lolium pratense</i> (Huds.) S.J. Darbyshire	meadow ryegrass	F	I
<i>Melica nutica</i> Walt.	twoflower melicgrass	I	N
<i>Muhlenbergia sobolifera</i> (Muhl. ex Willd.) Trin.	rock muhly	F	N
<i>Muhlenbergia sylvatica</i> Torr. ex Gray	woodland muhly	R	N
<i>Panicum anceps</i> Michx.	beaked panicgrass	O	N
<i>Panicum brachyanthum</i> Steud.	prairie panicgrass	R	N
<i>Panicum philadelphicum</i> Bernh. ex Trin.	Philadelphia panicgrass	O	N
<i>Panicum rigidulum</i> Bosc ex Nees	redtop panicgrass	R	N
<i>Panicum virgatum</i> L.	switchgrass	A	N
<i>Paspalum floridanum</i> Michx.	Florida paspalum	F	N
<i>Paspalum setaceum</i> Michx.	thin paspalum	F	N
<i>Piptochaetium avenaceum</i> (L.) Parodi	blackseed speargrass	R	N
<i>Poa arida</i> Vasey	plains bluegrass	R	N
<i>Saccharum brevibarbe</i> (Michx.) Pers.	shortbeard plumegrass*	R	N
<i>Schizachyrium scoparium</i> (Michx.) Nash	little bluestem	A	N
<i>Setaria parviflora</i> (Poir.) Kerguelen	marsh bristlegrass	F	N
<i>Sorghastrum nutans</i> (L.) Nash	Indiangrass	A	N
<i>Sorghum halepense</i> (L.) Pers.	Johnsongrass	A	I
<i>Sphenopholis obtusata</i> (Michx.) Scribn.	prairie wedgescale	F	N
<i>Steinchisma hiuis</i> (Fill.) Nash	gaping grass	O	N
<i>Tridens flavus</i> (L.) A.S. Hitchc.	purpletop tridens	O	N
<i>Tridens strictus</i> (Nutt.) Nash	longspike tridens	O	N
<i>Tripsacum dactyloides</i> (L.) L.	eastern gamagrass	O	N

	<i>Vulpia myuros</i> (L.) K.C. Gmel.	rat-tail fescue	F	I
Polemoniaceae	<i>Phlox pilosa</i> L.	downy phlox	O	N
Polygalaceae	<i>Polygala alba</i> Nutt	white milkwort	F	N
	<i>Polygala incarnata</i> L.	procession flower	F	N
	<i>Polygala polygama</i> Walt.	racemed milkwort	R	N
	<i>Polygala sanguinea</i> L.	purple milkwort	F	N
Polygonaceae	<i>Polygonum hydropiperoides</i> Michx.	swamp smartweed	A	N
	<i>Polygonum pensylvanicum</i> L.	Pennsylvania smartweed	I	N
	<i>Polygonum persicaria</i> L.	spotted ladysthumb	I	I
	<i>Polygonum punctatum</i> Ell.	dotted smartweed	I	N
	<i>Rumex crispus</i> L.	curly dock	I	I
	<i>Rumex hastatulus</i> Baldw.	heartwing sorrel	O	N
Polypodiaceae	<i>Pleopeltis polypodioides</i> (L.) Andrews & Windham	resurrection fern	R	N
Portulacaceae	<i>Claytonia virginica</i> L.	Virginia springbeauty	A	N
	<i>Talinum parviflorum</i> Nutt.	sunbright	R	N
Primulaceae	<i>Anagallis minima</i> (L.) Krause	chaffweed	I	N
Ranunculaceae	<i>Anemone caroliniana</i> Walt.	Carolina anemone	R	N
	<i>Delphinium carolinianum</i> Walt.	Carolina larkspur	R	N
	<i>Ranunculus fascicularis</i> Muhl. ex Bigelow	early buttercup	A	N
	<i>Thalictrum thalictroides</i> (L.) Eames & Boivin	rue anemone	R	N
Rhamnaceae	<i>Berchemia scandens</i> (Hill) K. Koch	Alabama supplejack	R	N
	<i>Ceanothus americanus</i> L.	New Jersey tea	I	N
	<i>Ceanothus herbaceus</i> Raf.	Jersey tea	F	N
	<i>Frangula caroliniana</i> (Walt.) Gray	Carolina buckthorn	I	N
Rosaceae	<i>Agrimonia rostellata</i> Wallr.	beaked agrimony	I	N
	<i>Amelanchier arborea</i> (Michx. f.) Fern.	common serviceberry	I	N
	<i>Crataegus crus-galli</i> L.	cockspur hawthorn	O	N

	<i>Geum canadense</i> Jacq.	white avens	R	N
	<i>Potentilla simplex</i> Michx.	common cinquefoil	I	N
	<i>Prunus mexicana</i> S. Wats.	Mexican plum	O	N
	<i>Prunus serotina</i> Ehrh.	black cherry	O	N
	<i>Rosa carolina</i> L.	Carolina rose	O	N
	<i>Rosa multiflora</i> Thunb. ex Murr.	multiflora rose	R	I
	<i>Rubus occidentalis</i> L.	black raspberry	A	N
Rubiaceae	<i>Cephalanthus occidentalis</i> L.	common buttonbush	I	N
	<i>Diodia teres</i> Walt.	poorjoe	F	N
	<i>Diodia virginiana</i> L.	Virginia buttonweed	R	N
	<i>Galium aparine</i> L.	stickywilly	I	N
	<i>Galium obtusum</i> Bigelow	bluntleaf bedstraw	I	N
	<i>Galium pilosum</i> Ait.	hairy bedstraw	I	N
	<i>Houstonia longifolia</i> Gaertn.	longleaf summer bluet	F	N
	<i>Houstonia pusilla</i> Schoepf	tiny bluets	F	N
	<i>Mitchella repens</i> L.	partridgeberry	R	N
	<i>Sherardia arvensis</i> L.	blue fieldmadder	A	I
Rutaceae	<i>Ptelea trifoliata</i> L.	common hoptree	R	N
Salicaceae	<i>Salix caroliniana</i> Michx.	coastal plain willow	R	N
Sapotaceae	<i>Sideroxylon lanuginosum</i> Michx.	gum bully	I	N
Saururaceae	<i>Saururus cernuus</i> L.	lizard's tail	R	N
Scrophulariaceae	<i>Agalinis heterophylla</i> (Nutt.) Small ex Britt.	prairie false foxglove	O	N
	<i>Aureolaria grandiflora</i> (Benth.) Pennell	largeflower yellow false foxglove	I	N
	<i>Castilleja indivisa</i> Engelm.	entireleaf Indian paintbrush	I	N
	<i>Gratiola brevifolia</i> Raf.	sticky hedgehyssop	R	N
	<i>Mecardonia acuminata</i> (Walt.) Small	axilflower	R	N

	<i>Mimulus alatus</i> Ait.	sharpwing monkeyflower	R	N
	<i>Nuttallanthus canadensis</i> (L.) D.A. Sutton	Canada toadflax	F	N
	<i>Pedicularis canadensis</i> L.	Canadian lousewort	I	N
	<i>Penstemon arkansanus</i> Pennell	Arkansas beardtongue	I	N
	<i>Penstemon digitalis</i> Nutt. ex Sims	talus slope penstemon	F	N
	<i>Scrophularia marilandica</i> L.	carpenter's square	I	N
	<i>Verbascum blattaria</i> L.	moth mullein	R	I
	<i>Verbascum thapsus</i> L.	common mullein	O	I
Simaroubaceae	<i>Ailanthus altissima</i> (P. Mill.) Swingle	tree of heaven	I	I
Smilacaceae	<i>Smilax bona-nox</i> L.	saw greenbrier	A	N
	<i>Smilax smallii</i> Morong	lanceleaf greenbrier	R	N
Solanaceae	<i>Physalis hederifolia</i> Gray	ivyleaf groundcherry	O	N
	<i>Solanum carolinense</i> L.	Carolina horsenettle	F	N
Tiliaceae	<i>Tilia americana</i> L. var. <i>caroliniana</i> (P. Mill.) Castigl.	Carolina basswood	R	N
Typhaceae	<i>Typha angustifolia</i> L.	narrowleaf cattail	I	I
Ulmaceae	<i>Celtis laevigata</i> Willd.	sugarberry	I	N
	<i>Ulmus alata</i> Michx.	winged elm	F	N
Urticaceae	<i>Boehmeria cylindrica</i> (L.) Sw.	smallspike false nettle	R	N
	<i>Parietaria pensylvanica</i> Muhl. ex Willd.	Pennsylvania pellitory	R	N
Valerianaceae	<i>Valerianella longiflora</i> (Torr. & Gray) Walp.	longtube comsalad	A	N
	<i>Valerianella radiata</i> (L.) Dufr.	beaked comsalad	F	N
Verbenaceae	<i>Callicarpa americana</i> L.	American beautyberry	A	N
	<i>Glandularia canadensis</i> (L.) Nutt.	rose mock vervain	F	N
	<i>Phryma leptostachya</i> L.	American lopseed	R	N
Violaceae	<i>Viola bicolor</i> Pursh	field pansy	I	N
	<i>Viola pedata</i> L.	birdfoot violet	A	N
	<i>Viola sagittata</i> Ait.	arrowleaf violet	F	N

	<i>Viola sororia</i> Willd.	common blue violet	I	N
Vitaceae	<i>Parthenocissus quinquefolia</i> (L.) Planch.	Virginia creeper	A	N
	<i>Vitis palmata</i> Vahl	catbird grape	A	N
	<i>Vitis rotundifolia</i> Michx.	muscadine	A	N
Xyridaceae	<i>Xyris difformis</i> Chapman	bog yelloweyed grass	R	N

\* Misspelled in PLANTS database.

\*\* Missing from PLANTS database



## APPENDIX B

### DIVISIONS, FAMILIES, GENERA, AND SPECIES COMPOSING THE FLORA OF THE PWMA WITH EACH TAXON'S GENERAL HABITAT AND AUTHOR'S COLLECTION NUMBERS

Relative abundance for species of the Pushmataha Wildlife Management Area  
is based on density of populations (Palmer, et al., 1995)

Density	Description
Abundant	Dominant or codominant in one or more common habitats.
Frequent	Easily seen or found in one or more common habitats but not dominant in any common habitat.
Occasional	Widely scattered but difficult to find.
Infrequent	Difficult to find with few individuals but found in several locations.
Rare	Very difficult to find and limited to one or very few locations or uncommon habitats

#### Pteridophyta

##### Aspleniaceae – Spleenwort Family

*Asplenium platyneuron* (L.) B.S.P. Ebony Spleenwort. Pine-hardwood forest along Divide Creek; occasional. 757-758, 1396.

##### Dennstaedtiaceae – Bracken Fern Family

*Pteridium aquilinum* (L.) Kuhn. Brackenfern. Along firebreak in the PFHRA under dense canopy of *Carya tomentosa*; infrequent. 1146-1148.

##### Dryopteridaceae – Wood Fern Family

*Woodsia obtusa* (Spreng.) Torr. Bluntlobe Cliff Fern. Along drainage in glade with occasional rock outcrops under partial canopy of *Pinus echinata*; frequent. 727-729.

*Polystichum acrostichoides* (Michx.) Schott. Christmas Fern. Under dense canopy in bottomlands of hardwood forest; frequent. 1461-1463.

##### Ophioglossaceae – Adder's Tongue Family

*Botrychium virginianum* (L.) Sw. Rattlesnake fern. Bottomland near Caney Creek under canopy of *Liquidambar styraciflua*; rare. 1286-1288.

### Polypodiaceae - Polypod Family

*Pleopeltis polypodioides* (L.) Andrews & Windham. Resurrection Fern. Found on rocks and tree branches in lowland areas of pine-hardwood forest. It was always observed in association with mosses, liverworts, and lichens; rare. 1723-1725.

## Coniferophyta

### Cupressaceae – Cypress family

*Juniperus virginiana* L. Eastern redcedar. Roadsides in upland areas and occasionally under canopy of *Pinus* spp. and *Carya* spp.; frequent. 1361-1363.

### Pinaceae – Pine Family

*Pinus echinata* P. Mill. Shortleaf pine. Pine-hardwood forest; abundant. 1221-1222.

*Pinus taeda* L. Loblolly pine. Clearcut treatment plots on the PFHRA; occasional. 1295-1297.

## Magnoliophyta: Magnoliopsida

### Acanthaceae – Acanthus Family

*Justicia americana* (L.) Vahl. American water-willow. Imbedded between rocks in Caney Creek; occasional. 1398-1400.

*Justicia ovata* (Walt.) Lindau var. *lanceolata* (Chapman) R.W. Long. Looseflower water-willow. Lowland floodplain of Kiamichi River under canopy of *Liquidambar styraciflua* and *Carpinus caroliniana*; rare. 1494-1496.

*Ruellia humilis* Nutt. Fringeleaf wild petunia. Disturbed areas along roadways and food plots; frequent. 613.

*Ruellia pedunculata* Torr. ex Gray. Stalked wild petunia. Dry, rocky areas of pine-hardwood forest; infrequent. 653,1460.

### Aceraceae – Maple Family

*Acer rubrum* L. Red Maple. Low-woods forests near creeks and along drainages; frequent. 1218.

### Anacardiaceae – Sumac Family

- Rhus aromatica* Ait. Fragrant sumac. Floodplain along Caney Creek in hardwood forest; infrequent. 1216.
- Rhus copallina* L. Flameleaf sumac. Along roadways and in burned treatment plots of the PFHRA; abundant. 737-738, 1610.
- Rhus glabra* L. Smooth sumac. Along roadways and in HT treatments of the PFHRA; frequent. 1418-1420.
- Toxicodendron radicans* (L.) Kuntze. Eastern poison ivy. Unburned or rarely burned hardwood and mixed-pine hardwoods forests in lowlands and uplands, often as a liana; abundant. 785-786.

### Apiaceae Carrot Family

- Ammoselinum popei* Torr. & Gray. Plains sandparsley. Bottomlands and moist pine-hardwood forests and in CCSP, HT2, and HT3 treatment plots of the PFHRA; infrequent. 517-518, 1479.
- Cicuta maculata* L. Spotted water hemlock. Along North Cedar and Caney Creeks, often in standing water; infrequent. 1430-1432.
- Cryptotaenia canadensis* (L.) DC. Canadian honewort. Bottomland along Kiamichi River; infrequent. 1637-1639.
- Cynosciadium digitatum* DC. Finger dogshade. Bottomland along Kiamichi River under dense canopy of *Morus rubra* and *Liquidambar styraciflua*; infrequent. 1496-1498.
- Daucus pusillus* Michx. American wild carrot. Along roadsides and food plots and in highly disturbed areas; abundant. 1540-1542.
- Eryngium yuccifolium* Michx. Button eryngo. Open burned areas of the PFHRA and also along open drainages, often with *Cuscuta pentagona* growing on it; frequent. 708-709, 798.
- Polytaenia nuttallii* DC. Nuttall's prairie parsley. Moist, rocky glade adjacent to food plot along Pine Tree Circle; infrequent. 1303-1305.
- Ptilimnium nuttallii* (DC.) Britt. Laceflower. Along drainages in burned, open areas of the PFHRA; frequent. 666-667, 1259, 1313.

*Sanicula canadensis* L. Canadian blacksnakeroot. Moist lowland areas in hardwood forest, often along drainages; occasional. 759, 1483, 1571, 1585-1586.

*Spermolepis divaricata* (Walt.) Raf. ex Ser. Roughfruit scaleseed. Along burned roadsides and the CCSP, HT1, HT2, and HT3 treatment plots of the PFHRA; infrequent. 687-688, 1524.

*Thaspium trifoliatum* (L.) Gray. Purple meadowparsnip. Moist lowland areas in hardwood forest, often along drainages; occasional. 531-532.

*Torilis arvensis* (Huds.) Link. Spreading hedgeparsley. Disturbed, open roadsides; infrequent. 1554-1556.

*Zizia aurea* (L.) W.D.J. Koch. Golden zizia. Moist lowland areas in hardwood forest, often along drainages; infrequent. 1257-1258.

#### Aquifoliaceae – Holly Family

*Ilex decidua* Walt. Possumhaw. Moist lowland in hardwood forest along drainage of Caney Creek; rare. 898-900.

*Ilex opaca* Ait. American holly. Uplands in pine-hardwood forest; rare. 1562-1564.

#### Asclepiadaceae – Milkweed Family

*Asclepias hirtella* (Pennell) Woods. Green milkweed. Along roadsides and in all treatment plots of the PFHRA; frequent. 735-736, 784.

*Asclepias tuberosa* L. Butterfly milkweed. Along roadsides and in the HT4 treatment plots of the PFHRA; frequent. 664-665, 1474.

*Asclepias variegata* L. Redring milkweed. Under dense canopy of pine-hardwood forest and in control and RRB treatments of the PFHRA; frequent. 703, 730, 1392.

*Asclepias verticillata* L. Whorled milkweed. Pine-hardwood forests and in the HT treatment plots of the PFHRA; frequent. 776.

*Asclepias viridis* Walt. Green antelopehorn. Glades and dry hillsides in direct sunlight; frequent. 710-711, 1377.

*Cynanchum laeve* (Michx.) Pers. Honeyvine. Lowland floodplain of Kiamichi River under canopy of *Liquidambar styraciflua* and *Carpinus caroliniana* and climbing on *Rubus occidentalis*; rare. 1645-1647.

Asteraceae -- Aster Family

- Achillea millefolium* L. Common yarrow. Open, burned roadsides and the HT1 and HT2 treatment plots of the PFHRA; frequent. 592-593, 1364.
- Ambrosia artemisiifolia* L. Annual ragweed. Open, burned roadsides and the CCSP, HT2, HT3, HT4, and HNT1 treatment plots of the PFHRA; occasional. 1167-1169.
- Ambrosia bidentata* Michx. Lanceleaf ragweed. In lower campground along disturbed access road; occasional. 1158-1160.
- Antennaria parlinii* Fern. Parlin's pussytoes. Under dense canopy of pine-hardwood forest, often in deep litter; frequent. 463-464, 1214.
- Arnoglossum plantagineum* Raf. Groovestem Indian plaintain. Open, burned roadsides and burned treatments of the PFHRA; occasional. 770-771, 1548.
- Astranthium integrifolium* (Michx.) Nutt. Entireleaf western daisy. Along an intermittent drainage that feeds Jerusalem Creek; infrequent. 760-761, 1397.
- Bidens aristosa* (Michx.) Britt. Bearded beggarticks. Floodplain of Caney Creek; infrequent. 1685.
- Bidens bipinnata* L. Spanish needles. Low-woods along the Kiamichi River under shade of *Carpinus caroliniana*; rare. 1624-1626.
- Boltonia diffusa* Ell. Smallhead doll's daisy. Along burned roadsides, often in sand; occasional. 1031-1033.
- Chaetopappa asteroides* Nutt. ex DC. Arkansas lestdaisy. Glades and dry hillsides in direct sunlight; occasional. 565-566, 1472.
- Cirsium altissimum* (L.) Hill. Tall thistle. Open, disturbed areas along roadsides and in the unburned treatments of the PFHRA; occasional. 1102-1104.
- Cirsium carolinianum* (Walt.) Fern. & Schub. Soft thistle. Upland hardwood forests and in all treatment plots of the PFHRA; occasional. 701-702, 1368.
- Conoclinium coelestinum* (L.) DC. Blue mistflower. Bottomlands and moist wooded areas in pine-hardwood forest; infrequent. 1681-1683.
- Conyza canadensis* (L.) Cronq. Canadian horseweed. Along roadsides and in open, disturbed areas; occasional. 1052-1054.

- Coreopsis grandiflora* Hogg ex Sweet. Largeflower tickseed. Along roadsides and all treatment plots of the PRHRA; abundant. 545-546, 576-580, 1312.
- Coreopsis palmata* Nutt. Largeflower tickseed. Glades and dry hillsides in direct sunlight; frequent. 691-692.
- Coreopsis tinctoria* Nutt. Golden tickseed. Along burned roadsides in direct sunlight; abundant. 774-775, 1561.
- Coreopsis tripteris* L. Tall tickseed. Rocky streambed of Caney Creek; infrequent. 1062-1064.
- Echinacea pallida* (Nutt.) Nutt. Pale purple coneflower. Along open, burned roadsides and in all treatment plots of the PFHRA; occasional. 608-609, 644-645.
- Elephantopus carolinianus* Raeusch. Carolina elephantsfoot. Floodplain of Caney Creek under canopy of *Liquidambar styraciflua* and *Betula nigra*; infrequent. 1686-1688.
- Erechtites hieracifolia* (L.) Raf. ex DC. American burnweed. Disturbed areas and in the CONT, CCSP, HT, HT1, PBS, and RRB treatment plots of the PFHRA; infrequent. 1173-1175.
- Erigeron annuus* (L.) Pers. Eastern daisy fleabane. Floodplain of the Kiamichi River along overgrown roadway; infrequent. 1636.
- Erigeron strigosus* Muhl. ex Willd. Prairie fleabane. Along roadsides, in pine-hardwood forests, and in all treatment plots of the PFHRA; abundant. 583-584, 1330.
- Eupatorium capillifolium* (Lam.) Small. Dogfennel. At edge of glade along disturbed access road; infrequent. 1778-1780.
- Eupatorium perfoliatum* L. Common boneset. In a moist drainage along burned roadsides; frequent. 1037-1039.
- Eupatorium serotinum* Michx. Lateflowering thoroughwort. Along burned roadside of Pine Tree Circle; occasional. 1164-1166.
- Eurybia paludosa* (Ait.) Nesom. Lateflowering thoroughwort. Along roadsides and in nearly all treatment plots of the PFHRA; frequent. 973-975.
- Fleischmannia incarnata* (Walt.) King & H.E. Robins. Pink thoroughwort. Along burned roadside in loamy soil; infrequent. 1114-1116.
- Gaillardia aestivalis* (Walt.) H. Rock. Lanceleaf blanketflower. Disturbed area in campground; rare. 964-966.

- Gamochaeta purpurea* (L.) Cabrera. Spoonleaf purple everlasting. Along open, burned roadsides and occasional in burned treatment plots of the PFHRA; infrequent. 1266-1269, 1523.
- Helenium amarum* (Raf.) H. Rock. Yellowdicks. Along burned roadsides in sandy and loamy soil; frequent. 745-746, 1553.
- Helenium autumnale* L. Common sneezeweed. Along open roadsides in moist drainages; frequent. 772-773.
- Helenium flexuosum* Raf. Common sneezeweed. Along open, disturbed roadsides in sandy soil; occasional. 1519, 1536-1537.
- Helianthus angustifolius* L. Swamp sunflower. In rocky drainage that feeds into Caney Creek under partial shade of *Cornus floridu*; infrequent. 1185-1187.
- Helianthus hirsutus* Raf. Hairy sunflower. Along roadsides, in pine-hardwood forests, and in all treatment plots of the PFHRA; abundant. 814-816.
- Helianthus mollis* Lam. Ashy sunflower. Along drainages in HT1 and HNT1 treatments of the PFHRA; occasional. 990-992.
- Heterotheca villosa* (Pursh) Shinnars. Hairy false goldenaster. Along open, disturbed roadsides; frequent. 842-844.
- Hieracium gronovii* L. Queendevil. Pine-hardwood and hardwood forests under dense canopy and often in deep litter, and also in CCSP, CONT, HNT1, and HT2 treatment plots of the PFHRA; occasional. 662-663, 1414.
- Hymenopappus scabiosaeus* L'Hér. Carolina woollywhite. Along less disturbed roadsides in direct sunlight; infrequent. 1365-1367.
- Krigia dandelion* (L.) Nutt. Potato dwarf dandelion. Along Divide Trail in pine-hardwood forest; occasional. 1260.
- Krigia virginica* (L.) Willd. Virginia dwarf dandelion. Along disturbed access road in the PFHRA; occasional. 473-474, 1228.
- Liatris elegans* (Walt.) Michx. Pinkscale blazing star. Open burned areas and glades, and particularly abundant in drainages of the PFHRA; occasional. 1108-1110, 1191-1193.
- Liatris pycnostachya* Michx. Prairie blazing star. Open southwest facing slope along River Road; frequent. 833-835.

- Liatris squarrosa* (L.) Michx. Scaly blazing star. Pine-hardwood and hardwood forests under dense canopy; occasional. 904-906.
- Liatris squarrulosa* Michx. Appalachian blazing star. Northwest facing slope in a pine-hardwood forest along an intermittent drainage that feeds into Cancy Creek; occasional. 1090-1092.
- Marshallia caespitosa* Nutt. ex DC. Puffballs. Along drainage in glade; rare. 610-611.
- Packera aurea* (L.) A. & D. Löve. Golden ragwort. Uplands and bottomlands of pine-hardwood forests; abundant. 513-514, 1215.
- Parthenium integrifolium* L. Wild quinine. Open disturbed roadsides, often in sandy soil; occasional. 685-686, 1105-1107, 1352.
- Pityopsis graminifolia* (Michx.) Nutt. Narrowleaf silkgrass. Along burned roadsides and in all treatment plots of the PFHRA except those burned annually; frequent. 1075-1077.
- Pseudognaphalium obtusifolium* (L.) Hilliard & Burt. Rabbittobacco. Along roadsides and in all treatment plots of the PFHRA; occasional. 1182-1184.
- Pyrrhopappus carolinianus* (Walt.) DC. Carolina desert-chicory. Along open roadsides, in glades, and in burned treatment plots of the PFHRA; occasional. 713-714, 723-724, 1508.
- Pyrrhopappus grandiflorus* (Nutt.) Nutt. Tuberos desert-chicory. Along open roadsides, in glades, and in burned treatment plots of the PFHRA; occasional. 529-530.
- Rudbeckia grandiflora* (D. Don) J.F. Gmel. ex DC. Rough coneflower. In the HT4 #18 treatment plot of the PFHRA; rare. 796-797, 1552.
- Rudbeckia hirta* L. Blackeyed Susan. Disturbed roadsides, upland pine-hardwood forests, and all treatment plots of the PFHRA; abundant. 654, 673-674.
- Silphium laciniatum* L. Compassplant. Along disturbed roadsides and in glades; infrequent. 907-909.
- Solidago nemoralis* Ait. Gray goldenrod. Along access road through lower campground; infrequent. 1152-1154.
- Solidago petiolaris* Ait. Downy ragged goldenrod. In HT1, HNT1, and PBS treatment plots of the PFHRA; infrequent. 1781-1783.



*Solidago radula* Nutt. Western rough goldenrod. In the HT1 treatment plots of the PFHRA; infrequent. 1197-1199.

*Solidago ulmifolia* Muhl. ex Willd. Elmleaf goldenrod. Disturbed roadsides, upland pine-hardwood forests, and all treatment plots of the PFHRA; abundant. 993-995.

*Symphotrichum lateriflorum* (L.) A. & D. Löve. Calico aster. Openings in upland pine-hardwood forests and in the RRB treatment of the PFHRA; occasional. 1176-1178.

*Symphotrichum patens* (Ait.) Nesom. Late purple aster. Disturbed roadsides, upland pine-hardwood forests, and all treatment plots of the PFHRA; frequent. 1161-1163.

*Verbesina helianthoides* Michx. Gravelweed. Along burned roadsides, often in sandy soil; infrequent. 715-716, 1393, 1775-1777.

*Verbesina virginica* L. White crownbeard. Roadsides and upland pine-hardwoods forests, often in loamy soils; infrequent. 1016, 1712.

*Vernonia baldwinii* Torr. Baldwin's ironweed. In drainages of burned areas and in the HNT1, HT2, HT4, and RRB treatment plots of the PFHRA; abundant. 877-879.

*Vernonia lettermannii* Engelm. ex Gray. Narrowleaf ironweed. In drainages of burned areas and in the HT2 and RRB treatment plots of the PFHRA; rare. 1017-1019.

#### Balsaminaceae – Touch-Me-Not Family

*Impatiens capensis* Meerb. Jewelweed. Floodplain of the Kiamichi River along an abandoned roadway; rare. 1499-1501.

#### Berberidaceae – Barberry Family

*Podophyllum peltatum* L. Mayapple. Low-woods along Caney Creek under dense canopy of *Liquidambar styraciflua* and *Ostrya virginiana*; infrequent. 1283-1285.

#### Betulaceae Birch Family

*Alnus serrulata* (Ait.) Willd. Hazel alder. Floodplains of creeks and streams; frequent. 1784-1786.

*Betula nigra* L. River birch. Floodplains of creeks and streams; frequent. 1568-1570.

*Carpinus caroliniana* Walt. American hornbeam. Low-woods along the Kiamichi River; rare. 1491-1493.

*Ostraya virginiana* (Mill.) K. Koch. Hophornbeam. Bottomlands near creeks, drainages, and ponds; frequent. 864, 1217, 1455-1456, 1609.

Bignoniaceae Trumpet-Creeper Family

*Campsis radicans* (L.) Seemann. Trumpet creeper. Edge of food plots in direct sunlight; infrequent. 764-765, 1511.

*Catalpa bignonioides* Walt. Southern catalpa. Along southern branch of Pine Tree Circle; infrequent. 1666-1668.

Boraginaceae – Borage Family

*Myostis verna* Nutt. Spring forget-me-not. Open, burned roadsides; rare. 525-526.

Brassicaceae – Mustard Family

*Cardamine parviflora* L. Sand bittercress. Open pine-hardwood forests, often along drainages and creeks; frequent. 482-483.

*Lepidium virginicum* L. Virginia pepperweed. Open, disturbed roadsides, often in sandy soil; occasional. 699-700, 1272.

Buddlejaceae – Buddleja Family

*Polypremum procumbens* L. Juniper leaf. Hardwood forest bottomland along the Kiamichi River; rare. 829, 982-983.

Cactaceae – Cactus Family

*Opuntia macrorhiza* Engelm. Twistspine pricklypear. In open glades and the CONT #1 treatment plot of the PFHRA; rare. 1525.

Campanulaceae Bellflower Family

*Lobelia cardinalis* L. Cardinalflower. Floodplain of Caney Creek; rare. Photograph.

*Lobelia puberula* Michx. Downy lobelia. In glades and open, burned areas, often in damp or wet soil; infrequent. 1208-1210.

*Lobelia spicata* Lam. Palespike lobelia. Open roadsides and in the burned treatment plots of the PFHRA; frequent. 620-621, 865-867.

*Triodanis perfoliata* (L.) Nieuwl. Claspig Venus' looking-glass. Along burned roadsides and in open pine-hardwood forests; occasional. 567-568.

#### Caprifoliaceae – Honeysuckle Family

*Sambucus nigra* L. European black elderberry. Adjacent to pond along Pine Tree Circle; rare. 762-763, 1526.

*Symphoricarpos orbiculatus* Moench. Coralberry. Hardwood and pine-hardwood forests, often in moist areas and along creeks and drainages; frequent. 1141-1142.

*Viburnum rufidulum* Raf. Rusty blackhaw. Open pine-hardwood forests; rare. 1675-1676.

#### Caryophyllaceae – Pink Family

*Minuartia drummondii* (Shinners) McNeill. Drummond's stitchwort. Glades and open areas with sandy soil; frequent. 1327-1329.

*Minuartia patula* (Michx.) Mattf. Pitcher's stitchwort. Glades, open roadsides, and areas with rock outcrops; abundant. 1326.

*Silene stellata* (L.) Ait. f. Widowsfrill. Bottomland in open hardwood forests; infrequent. 1582-1584.

*Stellaria media* (L.) Vill. Common chickweed. Disturbed roadsides and mowed areas near campgrounds and shooting ranges; frequent. 1245.

#### Celastraceae – Staff-tree Family

*Euonymus americana* L. Strawberry bush. Low-woods near the Kiamichi River; rare. 1490, 1761-1762.

#### Cistaceae – Rock-rose Family

*Lechea tenuifolia* Michx. Narrowleaf pinweed. Open burned areas and all the burned treatment plots of the PFHRA; abundant. 1426-1428.

### Clusiaceae – St. John's Wort Family

*Hypericum densiflorum* Pursh. Bushy St. Johnswort. Pine-hardwood forests along creeks and drainages; infrequent. 892-894.

*Hypericum drummondii* (Grev. & Hook.) Torr. & Gray. Nits and lice. Open areas with dry, sandy soil and in all the burned treatment plots of the PFHRA; infrequent. 808-810.

*Hypericum hypericoides* (L.) Crantz. St. Andrew's cross. Pine-hardwood forests under a dense canopy, often in moist soils; occasional. 976-978, 998-1000.

*Hypericum mutilum* L. Dwarf St. Johnswort. On the edge of streams and drainages, often in direct sunlight; infrequent. 984-986.

*Hypericum punctatum* Lam. Spotted St. Johnswort. Along Caney Creek under canopy of *Liquidambar styraciflua* and *Ostrya virginiana*; rare. 1603-1604.

### Convolvulaceae – Morning-glory Family

*Ipomoea lacunosa* L. Whitestar. Along sandy, rocky edge of the Kiamichi River; occasional. 1772-1774.

*Ipomoea pandurata* (L.) G.F.W. Mey. Man of the earth. In sandy soil along abandoned access road to the Kiamichi River; rare. 940.

### Cornaceae – Dogwood Family

*Cornus obliqua* Raf. Silky dogwood. Low-woods area along Peterson Creek; rare. 1346-1348.

*Cornus florida* L. Flowering dogwood. Along Pine Tree Circle near entrance to area; rare. 496-497, 1239.

### Crassulaceae – Stonecrop Family

*Penthorum sedoides* L. Ditch stonecrop. Bottomland along Caney Creek under canopy of *Betula nigra*; rare. 1698-1700.

### Cuscutaceae – Dodder Family

*Cuscuta indecora* Choisy. Bigseed alfalfa dodder. Growing on *Helianthus hirsutus* and *Polytaenia nuttallii* in all burned treatments of the PFHRA and along open roadsides; frequent. 1598.

*Cuscuta pentagona* Engelm. Fiveangled dodder. Growing on *Helianthus hirsutus*, *Coreopsis grandiflora*, and *Eryngium yuccifolium* along open roadsides; frequent. 787-788.

#### Ebenaceae – Ebony Family

*Diospyros virginiana* L. Common persimmon. Dry upland woods; rare. 1452-1454.

#### Elaeagnaceae – Oleaster Family

*Elaeagnus angustifolia* L. Russian olive. Along food plots and disturbed roadsides; frequent. 925-927.

*Elaeagnus umbellata* Thunb. Autumn olive. Along food plots and disturbed roadsides and in the CONT, CCSP, HT, and HT4 treatment plots of the PFHRA; frequent. 515-516, 1235-1236.

#### Ericaceae – Heath Family

*Vaccinium arboreum* Marsh. Farkleberry. Open pine-hardwood forests and along wooded streams and drainages; frequent. 1247-1249.

*Vaccinium stamineum* L. Deerberry. Open pine-hardwood forests and along wooded streams and drainages; occasional. 1250-1252.

#### Euphorbiaceae Spurge Family

*Acalypha gracilens* Gray. Slender threeseed mercury. Open burned areas and all of the treatment plots in the PFHRA, often in dry soil; abundant. 848-850.

*Acalypha virginica* L. Virginia threeseed mercury. In sandy soil along Kiamichi River floodplain; rare. 1657-1659.

*Chamaesyce nutans* (Lag.) Small. Eyebane. Upland hardwood forest under canopy of *Acer rubrum*; occasional. 1684.

- Croton capitatus* Michx. Hogwort. Open areas and along roadsides, often in sandy soil; frequent. 970-972.
- Croton glandulosus* L. Vente conmigo. Open areas with sandy or loamy soil; infrequent. 884-886.
- Croton monanthogynus* Michx. Prairie tea. Along open roadsides, often in sandy soil; abundant. 931-933.
- Croton willdenowii* G.L. Webster. Willdenow's croton. Southeast facing hillsides in burned areas, often in dry soil; occasional. 958-960.
- Euphorbia heterophylla* L. Mexican fireplant. In hardwood forest along drainage that feeds Caney Creek; rare. 1705-1707.
- Euphorbia tetrapora* Engelm. Weak spurge. In the CONT #10 treatment plot of the PFHRA under dense canopy of *Carya tomentosa*; rare. 1543.
- Tragia betonicifolia* Nutt. Betonyleaf noseburn. Rocky edge of Caney Creek in direct sunligh; rare. 1600-1602.

#### Fabaceae – Pea Family

- Albizia julibrissin* Durazz. Silktree. Edge of roadside clearings; infrequent. 1614-1616.
- Amorpha laevigata* Nutt. Smooth false indigo. Floodplain of Caney Creek; rare. 1058-1060.
- Amphicarpaea bracteata* (L.) Fern. American hogpeanut. In pine and pine-hardwood forests under dense canopy; frequent. 1719, 1726-1727.
- Baptisia bracteata* Muhl. ex Ell. Longbract wild indigo. Burned areas or open pine-hardwood forests and all treatment plots of the PFHRA; frequent. 519-520, 1264.
- Cercis canadensis* L. Eastern redbud. Edge of roadside clearings and lowland hardwood forests; occasional. 1242-1244.
- Chamaecrista fusciculata* (Michx.) Greene. Sleepingplant. Burned roadsides and burned treatments of the PFHRA; abundant. 934-936.
- Clitoria mariana* L. Atlantic pigeonwings. Open, burned areas and all plots of the PFHRA but the RRB and PBS treatments; abundant. 781-783.
- Crotalaria sagittalis* L. Arrowhead rattlebox. Open, burned uplands HT1, HNT1, HT2, and HT4 treatment plots of the PFHRA; frequent. 789-791.

- Desmodium canadense* (L.) DC. Showy ticktrefoil. Open, burned pine-hardwood forests; frequent. 1093-1095.
- Desmodium canescens* (L.) DC. Hoary ticktrefoil. Dry, sandy hardwood forest along Peterson Creek; rare. 1704.
- Desmodium ciliare* (Muhl. ex Willd.) DC. Hairy small-leaf ticktrefoil. Open, burned uplands and burned treatment plots of the PFHRA; frequent. 996-997, 1711.
- Desmodium paniculatum* (L.) DC. Panicleleaf ticktrefoil. Open, burned uplands and all treatment plots of the PFHRA; frequent. 1689-1691.
- Desmodium pauciflorum* (Nutt.) DC. Fewflower ticktrefoil. Hardwoods forest in bottomland along creeks and streams; frequent. 1662-1664.
- Desmodium sessilifolium* (Torr.) Torr. & Gray. Sessileleaf ticktrefoil. Dry, sandy hardwood forests; frequent. 1078-1080.
- Desmodium viridiflorum* (L.) DC. Velvetleaf ticktrefoil. Open, burned uplands and all treatment plots of the PFHRA; frequent. 1716-1718.
- Galactia regularis* (L.) B.S.P. Eastern milkpea. Open, burned areas, uplands, bottomlands, and all treatment plots of the PFHRA; abundant. 854-856.
- Gleditsia triacanthos* L. Honeylocust. Bottomland along drainage that feeds Caney Creek; occasional. 1557-1559.
- Kummerowia striata* (Thunb.) Schindl. Japanese clover. Open, clearcut area northwest of PRHRA along wet drainage; infrequent. 1084-1086.
- Lespedeza cuneata* (Dum.-Cours.) G. Don. Chinese lespedeza. Weedy along the roadsides and food plots; abundant. 1081-1083.
- Lespedeza hirta* (L.) Hornem. Hairy lespedeza. Disturbed roadsides and open, burned areas; frequent. 1129-1130.
- Lespedeza procumbens* Michx. Trailing lespedeza. Open pine-hardwood forests and burned areas; infrequent. 1720-1722.
- Lespedeza repens* (L.) W. Bart. Creeping lespedeza. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 629-630, 1592.
- Lespedeza stuevei* Nutt. Tall lespedeza. Open, burned glade; frequent. 1013-1015.

- Lespedeza virginica* (L.) Britt. Slender lespedeza. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 721-722, 1072-1074, 1099-1101.
- Medicago lupulina* L. Black medick. Food plots and along open, disturbed roadsides; frequent. 523-524, 1376.
- Mimosa quadrivalvis* L. Fourvalve mimosa. Disturbed roadside ditches; abundant. 668-669.
- Psoralidium tenuiflorum* (Pursh) Rydb. Slimflower scurfpea. Open, burned hardwood forests and the PBS treatment plot of the PFHRA; abundant. 581-582, 717-718.
- Rhynchosia latifolia* Nutt. ex Torr. & Gray. Prairie snoutbean. Open, burned uplands; infrequent. 889-891.
- Robinia pseudoacacia* L. Black locust. Bottomland along drainage that feeds Caney Creek; infrequent. 1672-1674.
- Strophostyles helvula* (L.) Ell. Trailing fuzzybean. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 851-853.
- Strophostyles umbellata* (Muhl. ex Willd.) Britt. Pink fuzzybean. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 857, 883.
- Stylosanthes biflora* (L.) B.S.P. Sidebeak pencilflower. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 631-632, 1409.
- Tephrosia virginiana* (L.) Pers. Virginia tephrosia. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 675-676, 1413.
- Trifolium pratense* L. Red clover. Food plots and along open, disturbed roadsides; occasional. 618-619, 1270.
- Vicia sativa* L. Garden vetch. Power line right-of way in direct sunlight; occasional. 1262.
- Vicia villosa* Roth. Winter vetch. Food plots and along open, disturbed roadsides; abundant. 642-643.



#### Fagaceae Beech Family

*Quercus alba* L. White oak. Bottomland near Caney Creek; rare. 1572-1574.

*Quercus marilandica* Muenchh. Blackjack oak. Ridgetops and dry hillsides of pine-hardwood forests; abundant. 488-489, 1233-1234.

*Quercus nigra* L. Water oak. Bottomland near Caney and North Cedar Creeks; rare. 979-981, 1565-1567.

*Quercus stellata* Wangenh. Post oak. Ridgetops and dry hillsides of pine-hardwood forests; abundant. 511-512, 1240-1241.

*Quercus velutina* Lam. Black oak. Ridgetops and dry hillsides of pine-hardwood forests; abundant. 1530-1532.

#### Fumariaceae – Fumitory Family

*Corydalis crystallina* Engelm. Mealy fumewort. In wet, rocky bed of drainage that feeds Caney Creek; occasional. 509-510, 1269.

#### Gentianaceae - Gentian Family

*Sabatia campestris* Nutt. Texas star. Wet drainages in open, frequently burned areas and in the HT4 treatment of the PFHRA; infrequent. 794-795, 1560.

#### Geraniaceae - Geranium Family

*Geranium carolinianum* L. Carolina geranium. Disturbed roadsides and the HT treatment of the PFHRA, often in sandy soil; infrequent. 706-707, 1276.

#### Grossulariaceae – Gooseberry Family

*Ribes cynosbati* L. Eastern prickly gooseberry. Rocky area in floodplain of Caney Creek; rare. 1588-1590.

#### Hamamelidaceae -- Witch hazel Family

*Liquidambar styraciflua* L. Sweetgum. Bottomlands near creeks and streams, often in moist soil; frequent. 755-756, 1587.

### Hydrophyllaceae - Waterleaf Family

*Hydrolea ovata* Nutt. ex Choisy. Ovate false fiddleleaf. In rocky, intermittent creek bed under dense canopy of hardwood forest; occasional. 1034-1036, 1651-1653.

*Nemophila phacelioides* Nutt. Largeflower baby blue eyes. Open pine hardwood forest in sandy soil; rare. 561-562.

### Juglandaceae – Walnut Family

*Carya alba* (L.) Nutt. ex Ell. Mockernut hickory. Ridgetops and dry hillsides of pine-hardwood forests; abundant. 1292-1294, 1298-1300.

*Carya cordiformis* (Wangenh.) K. Koch. Bitternut hickory. Bottomlands of pine-hardwood forests; infrequent. 1749-1751.

*Carya texana* Buckl. Black hickory. Ridgetops and dry hillsides of pine-hardwood forests; abundant. 1621-1623.

*Juglans nigra* L. Black walnut. Low-woods forest along the Kiamichi River; rare. 1640-1642.

### Lamiaceae – Mint Family

*Cunila origanoides* (L.) Britt. Common dittany. Rocky area along Caney Creek and small drainages; infrequent. 1194-1196.

*Lycopus virginicus* L. Virginia water horehound. Along streams in hardwood forests; infrequent. 1740-1742.

*Monarda fistulosa* L. Wild bergamot. Disturbed roadside ditches and edges of pine-hardwood forests; infrequent. 1611-1613.

*Monarda russeliana* Nutt. ex Sims. Redpurple beebalm. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 578-579, 1311.

*Perilla frutescens* (L.) Brit. Beefsteakplant. Low-woods forest near the Kiamichi River in area grazed by cattle; infrequent. 1743-1745.

*Prunella vulgaris* L. Common selfheal. Pine-hardwoods forests and along access roads through the PFHRA; occasional. 587-588, 1315.

- Pycnanthemum albescens* Torr. & Gray. Whiteleaf mountainmint. Along drainage that feeds Jerusalem Creek; rare. 1040, 1047-1048.
- Pycnanthemum tenuifolium* Schrad. Narrowleaf mountainmint. Burned areas, open pine hardwood forests, and all treatment plots of the PFHRA except the CONT treatments, often in moist sites; occasional. 820-822.
- Salvia azurea* Michx. ex Lam. Azure blue sage. Low-woods forest near Cancy Creek; rare. 1096-1098.
- Salvia lyrata* L. Lyreleaf sage. Along abandoned roadways near Jerusalem and Peterson Creeks and the Kiamichi River; infrequent. 888, 1281.
- Scutellaria elliptica* Muhl. ex Spreng. Hairy skullcap. Low-woods forest near the Kiamichi River under dense canopy of *Morus rubra* and *Liquidambar styraciflua*; rare. 1502-1504.
- Scutellaria ovata* Hill. Heartleaf skullcap. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 681-682, 1538.
- Teucrium canadense* L. Canada germander. Bottomland near Kiamichi River in area grazed by cattle, under dense canopy of *Juglans nigra*; occasional. 1643.
- Trichostema dichotomum* L. Forked bluecurls. Adjacent to ponds and along drainages; infrequent. 1117-1119.

#### Lauraceae – Laurel Family

- Lindera benzoin* (L.) Blume. Northern spicebush. Bottomland near the Kiamichi River under dense canopy of *Liquidambar styraciflua* and *Nyssa sylvatica*; rare. 1752-1754.
- Sassafras albidum* (Nutt.) Nees. Sassafras. Bottomland near the Kiamichi River under dense canopy of *Liquidambar styraciflua* and *Nyssa sylvatica*; rare. 1633-1635.

#### Malvaceae – Mallow Family

- Callirhoe digitata* Nutt. Winecup. Along burned roadside; rare. 612, 659, 1436.

#### Melastomataceae – Meadow-beauty Family

*Rhexia mariana* L. Maryland meadowbeauty. Marshy sites in open, burned areas; infrequent. 987-989.

#### Moraceae – Mulberry Family

*Morus rubra* L. Red mulberry. Open areas near creeks and streams; infrequent. 1457-1459.

#### Nymphaeaceae – Water-Lily Family

*Nuphar lutea* (L.) Sm. Yellow pond-lily. Floating in ponds or stagnate creeks; infrequent. 1061, 1421-1422.

#### Nyssaceae – Sour Gum Family

*Nyssa sylvatica* Marsh. Blackgum. Bottomlands along creeks, streams, and drainages; occasional. 1449-1551.

#### Oleaceae – Olive Family

*Fraxinus americana* L. White ash. Edge of upland pine-hardwood forests; occasional. 1126-1128.

*Fraxinus pennsylvanica* Marsh. Green ash. In a deep drainage that feeds the Kiamichi River; occasional. 1766-1768.

*Ligustrum sinense* Lour. Chinese privet. Along abandoned access road that parallels Peterson Creek; occasional. 1349-1351.

#### Onagraceae – Evening Primrose Family

*Ludwigia alternifolia* L. Seedbox. In wet ditches and open drainages; occasional. 766-767.

*Oenothera fruticosa* L. Narrowleaf evening-primrose. Northeast facing hillsides, often in moist soil or along drainages; frequent. 543-544, 672, 1333.

*Oenothera laciniata* Hill. Cutleaf evening-primrose. Along open drainages and creeks; occasional. 887, 1271.

*Oenothera linifolia* Nutt. Threadleaf evening-primrose. Open, burned pine-hardwood forests, disturbed roadsides, and the HT2 and HT3 treatment plots of the PFHRA, often in sandy soil; frequent. 551-552, 1314.

#### Oxalidaceae - Wood Sorrel Family

*Oxalis stricta* L. Common yellow oxalis. Burned pine-hardwood forests, disturbed roadsides, and the CONT and RRB treatment plots of the PFHRA; abundant. 549-550, 1279.

*Oxalis violacea* L. Violet woodsorrel. Open, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA except the PBS; abundant. 484-485, 1132, 1139-1140, 1231.

#### Passifloraceae – Passion-flower Family

*Passiflora incarnata* L. Purple passionflower. Open grazed area at edge of woods near the Kiamichi River; rare. 1644.

*Passiflora lutea* L. Yellow passionflower. Bottomland along Jerusalem Creek under dense hardwood canopy; rare. 1068.

#### Phytolaccaceae – Pokeweed Family

*Phytolacca americana* L. American pokeweed. Disturbed roadsides and power line right-of-way; occasional. 749-750, 1591.

#### Plantaginaceae - Plantain Family

*Plantago aristata* Michx. Largebracted plantain. Disturbed areas and burned treatment plots of the PFHRA; occasional. 679-680, 1429.

*Plantago major* L. Common plantain. Bottomland near the Kiamichi River under dense canopy of *Liquidambar styraciflua* and *Nyssa sylvatica*; rare. 1630-1632.

*Plantago virginica* L. Virginia plantain. Disturbed areas and burned treatment plots of the PFHRA; occasional. 570-571, 1278, 1373.

### Platanaceae – Plant-tree Family

*Platanus occidentalis* L. American sycamore. Along drainages in uplands and bottomlands; infrequent. 1594-1596.

### Polemonaceae – Phlox Family

*Phlox pilosa* L. Downy phlox. Disturbed roadsides and all burned treatment plots of the PFHRA, often in sandy soil; occasional. 541-542, 683, 1254.

### Polygalaceae – Milkwort Family

*Polygala alba* Nutt. White milkwort. Disturbed roadsides and burned treatments of the PFHRA; occasional. 677-678, 1521.

*Polygala incarnata* L. Procession flower. Glades and in the HT1, HNT1, Ht2, and HT3 treatment plots of the PFHRA; occasional. 628, 641, 1528.

*Polygala polygama* Walt. Racemed milkwort. Open pine-hardwood forest adjacent to Caney Creek; rare. 1369-1371.

*Polygala sanguinea* L. Purple milkwort. Disturbed roadsides and annual burn treatment plots of the PFHRA; occasional. 651-652, 1522.

### Polygonaceae – Smartweed Family

*Polygonum hydropiperoides* Michx. Swamp smartweed. Roadside ditches, edges of ponds, and along creeks and streams, typically in standing water; abundant. 751-752, 1617.

*Polygonum pennsylvanicum* L. Pennsylvania smartweed. Sandy, rocky shore of the Kiamichi River; infrequent. 1769-1771.

*Polygonum persicaria* L. Spotted ladythumb. Roadside ditches, often in standing water; infrequent. 937-939.

*Polygonum punctatum* Ell. Dotted smartweed. Edge of Caney Creek under partial shade of *Acer rubrum*; infrequent. 1692-1694.

*Rumex crispus* L. Curly dock. In disturbed roadside ditches, often in standing water; infrequent. 626-627, 1353.

*Rumex hastatulus* Baldw. Heartwing sorrel. In disturbed roadside ditches; occasional. 733-734, 1331.

Portulacaceae Perslane Family

*Claytonia virginica* L. Virginia springbeauty. Pine-hardwood and hardwood forests, bottomlands, and disturbed roadsides; abundant. 479-480, 1280.

*Talinum parviflorum* Nutt. Sunbright. Glades and annual burns of the PRHRA; rare. 1001.

Primulaceae – Primrose Family

*Anagallis minima* (L.) Krause. Chaffweed. On southwest facing slope in drainages of annual burn treatments of the PFHRA; infrequent. 1410-1412.

Ranunculaceae Buttercup Family

*Anemone caroliniana* Walt. Carolina anemone. HT treatment plot of the PFHRA, in deep litter; rare. 477-478.

*Delphinium carolinianum* Walt. Carolina larkspur. Burned glade; rare. 725-726, 1471.

*Ranunculus fascicularis* Muhl. ex Bigelow. Early buttercup. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 459-460, 1229.

*Thalictrum thalictroides* (L.) Eames & Boivin. Rue anemone. Bottomland in grazed area near the Kiamichi River under dense canopy of *Carpinus caroliniana* and *Liquidambar styraciflua*; rare. 1797.

Rhamnaceae – Buckthorn Family

*Berchemia scandens* (Hill) K. Koch. Alabama supplejack. HT # 25 treatment plot of the PFHRA; rare. 1343-1345.

*Ceanothus americanus* L. New Jersey tea. Open pine-hardwood forests; infrequent. 637-638, 792-793.

*Ceanothus herbaceus* Raf. Jersey tea. Open pine-hardwood forests and the HT treatment in the PFHRA; frequent. 555-556, 1263.

*Frangula caroliniana* (Walt.) Gray. Carolina buckthorn. Bottomlands near creeks and drainages; infrequent. 1443-1445.

#### Rosaceae – Rose Family

*Agrimonia rostellata* Wallr. Beaked agrimony. Bottomland near Kiamichi River in area grazed by cattle under dense canopy of hardwood forest; infrequent. 1654-1656.

*Amelanchier arborea* (Michx. f.) Fern. Common serviceberry. Pine-hardwood forests; infrequent. 1533-1535.

*Crataegus crus-galli* L. Cockspur hawthorn. Bottomlands under canopy of pine-hardwood forest; occasional. 1446-1448.

*Geum canadense* Jacq. White avens. Along Caney Creek under dense shade of *Nyssa sylvatica* and *Quercus stellata*; rare. 1484-1485.

*Potentilla simplex* Michx. Common cinquefoil. Open disturbed roadsides; infrequent. 508, 1277.

*Prunus mexicana* S. Wats. Mexican plum. Ridgetop forest and often along roadsides; occasional. 467-468, 1069-1071.

*Prunus serotina* Ehrh. Black cherry. Mesic pine-hardwood forests; occasional. 1545-1547, 1677.

*Rosa carolina* L. Carolina rose. Along open roadsides and openings in pine-hardwood forests; occasional. 615-616, 1433-1435.

*Rosa multiflora* Thunb. ex Murr. Multiflora rose. Along Dogwood Road at edge of food plot; rare. 1372.

*Rubus occidentalis* L. Black raspberry. Open, burned roadsides, edges of food plots, and in all treatment plots of the PFHRA; abundant. 537-538, 1290.

#### Rubiaceae – Madder Family

*Cephalanthus occidentalis* L. Common buttonbush. Along creeks and drainages in direct sunlight; infrequent. 1055-1057.

*Diodia teres* Walt. Poorjoe. Along access roads in the PFHRA and in the HT1 and HNT1 treatment plots of the PFHRA; frequent. 805-807.



- Diodia virginiana* L. Virginia buttonweed. Bottomland near Kiamichi River in area grazed by cattle under dense canopy of hardwood forest; rare. 1648-1650.
- Galium aparine* L. Stickywilly. Adjacent to pond near the wildlife management area headquarters; infrequent. 1378-1380.
- Galium obtusum* Bigelow. Bluntleaf bedstraw. Rocky drainage in glade; infrequent. 1317-1319.
- Galium pilosum* Ait. Hairy bedstraw. In drainages, often under dense canopy of pine-hardwood forest; infrequent. 704-705, 1338, 1517.
- Houstonia longifolia* Gaertn. Longleaf summer bluet. Pine-hardwood forests; frequent. 521-522, 1253.
- Houstonia pusilla* Schoepf. Tiny bluets. Disturbed roadsides and burned treatments in the PFHRA; frequent. 461-462, 1230.
- Mitchella repens* L. Partridgeberry. Bottomland in grazed area near the Kiamichi River under dense canopy of *Carpinus caroliniana* and *Liquidambar styraciflua*; rare. 1488.
- Sherardia arvensis* L. Blue fieldmadder. Mowed shooting range; rare. 1473, 1509-1510.

#### Rutaceae – Rue Family

- Ptelea trifoliata* L. Common hoptree. Bottomland near the Kiamichi River under dense canopy of *Carpinus caroliniana* and *Liquidambar styraciflua*; rare. 1678.

#### Salicaceae – Willow Family

- Salix caroliniana* Michx. Coastal plain willow. Along Caney Creek in forest opening; rare. 535-536, 1256.

#### Sapotaceae – Sapodilla Family

- Sideroxylon lanuginosum* Michx. Gum bully. Uplands in pine-hardwood forests; infrequent. 1737-1739.

### Saururaceae – Lizard's tail Family

*Saururus cernuus* L. Lizard's tail. Bottomland near the Kiamichi River under dense canopy of *Carpinus caroliniana* and *Liquidambar styraciflua*; rare. 1505-1507.

### Scrophulariaceae – Figwort Family

*Agalinis heterophylla* (Nutt.) Small ex Britt. Prairie false foxglove. Open hardwood forests and edge of woods; occasional. 1136-1138.

*Aureolaria grandiflora* (Benth.) Pennell. Largeflower yellow false foxglove. Along banks of Caney Creek and in open drainages; infrequent. 1203-1204, 1679-1680.

*Castilleja indivisa* Engelm. Entireleaf Indian paintbrush. Open, burned roadsides; infrequent. 614, 1274-1275.

*Gratiola brevifolia* Raf. Sticky hedgehyssop. In rocky bed of Caney Creek where water is shallow; rare. 1023-1025.

*Mecardonia acuminata* (Walt.) Small. Axilflower. Along Caney Creek in direct sunlight; rare. 1731-1733.

*Mimulus alatus* Ait. Sharpwing monkeyflower. Along abandoned access road to the Kiamichi River under canopy of *Carpinus caroliniana*; rare. 1665, 1695-1697.

*Nuttallanthus canadensis* (L.) D.A. Sutton. Canada toadflax. Open roadsides and burned sites; frequent. 498-499, 712.

*Pedicularis canadensis* L. Canadian lousewort. Bottomlands near creeks and drainages, and in drainage of HNT1 #22 treatment plot of the PFHRA; infrequent. 533-534, 1246.

*Penstemon arkansanus* Pennell. Arkansas beardtongue. Open, disturbed roadsides, often in sandy soil; infrequent. 1402-1404.

*Penstemon digitalis* Nutt. ex Sims. Talus slope penstemon. In glades and open, burned areas; frequent. 547-548, 1301.

*Scrophularia marilandica* L. Carpenter's square. Bottomland near the Kiamichi River under dense canopy of *Nyssa sylvatica*; infrequent. 1758-1760.

*Verbascum blattaria* L. Moth mullein. Along disturbed access road through upper campground; rare. 684, 1406.

*Verbascum thapsus* L. Common mullein. Along open, disturbed roadsides; occasional. 880-882.

#### Simaroubaceae – Quassia Family

*Ailanthus altissima* (P. Mill.) Swingle. Tree of heaven. Southwest facing hillsides in disturbed areas and CCSP #7 treatment plot of the PFHRA; infrequent. 1618-1620.

#### Solanaceae – Nightshade Family

*Physalis hederifolia* Gray. Ivyleaf groundcherry. Disturbed, burned roadsides and all treatment plots of the PFHRA; occasional. 922-924.

*Solanum carolinense* L. Carolina horsenettle. Disturbed, burned roadsides and all treatment plots of the PFHRA except the CONT plots; frequent. 591, 617, 1405.

#### Tiliaceae – Linden Family

*Tilia americana* L. var. *caroliniana* (P. Mill.) Castigl. Carolina basswood. Floodplain of the Kiamichi River; rare. 1575-1577.

#### Ulmaceae – Elm Family

*Celtis laevigata* Willd. Sugarberry. Uplands and bottomlands near drainages; infrequent. 1423-1425.

*Ulmus alata* Michx. Winged elm. Uplands and bottomlands not frequently burned; frequent. 1220.

#### Urticaceae – Nettle Family

*Boehmeria cylindrica* (L.) Sw. Smallspike false nettle. In drainage that feeds the Kiamichi River under dense canopy of *Acer rubrum*; rare. 1087-1089, 1628.

*Parietaria pensylvanica* Muhl. ex Willd. Pennsylvania pellitory. Drainages of annual burns of the PFHRA, often in standing water; rare. 1599.

#### Valerianaceae – Valerian Family

*Verbascum thapsus* L. Common mullein. Along open, disturbed roadsides; occasional. 880-882.

#### Simaroubaceae – Quassia Family

*Ailanthus altissima* (P. Mill.) Swingle. Tree of heaven. Southwest facing hillsides in disturbed areas and CCSP #7 treatment plot of the PFHRA; infrequent. 1618-1620.

#### Solanaceae – Nightshade Family

*Physalis hederifolia* Gray. Ivy leaf groundcherry. Disturbed, burned roadsides and all treatment plots of the PFHRA; occasional. 922-924.

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*Parietaria pensylvanica* Muhl. ex Willd. Pennsylvania pellitory. Drainages of annual burns of the PFHRA, often in standing water; rare. 1599.

#### Valerianaceae – Valerian Family

*Valerianella longiflora* (Torr. & Gray) Walp. Longtube cornsalad. Open, burned areas, roadsides, and glades; abundant. 559-560.

*Valerianella radiata* (L.) Dufur. Beaked cornsalad. Open burned areas and glades; frequent. 557-558, 1273.

#### Verbenaceae - Vervain Family

*Callicarpa americana* L. American beautyberry. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 817-819.

*Glandularia canadensis* (L.) Nutt. Rose mock vervain. Open, disturbed roadsides and edges of food plots; frequent. 469-470, 1049-1051, 1223.

*Phryma leptostachya* L. American lopseed. Floodplain along Caney Creek under dense canopy of *Carya tomentosa*; rare. 1578-1580.

#### Violaceae -- Violet Family

*Viola bicolor* Pursh. Field pansy. Pine-hardwood forest; infrequent. 494-495.

*Viola pedata* L. Birdfoot violet. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 465-466, 1232.

*Viola sagittata* Ait. Arrowleaf violet. Pine-hardwood forests and disturbed roadsides; frequent. 490-491, 500-501, 1219, 1224.

*Viola sororia* Willd. Common blue violet. Bottomland near Kiamichi River in area grazed by cattle under canopy of *Carpinus caroliniana*; infrequent. 1627.

#### Vitaceae – Grape Family

*Parthenocissus quinquefolia* (L.) Planch. Virginia creeper. Uplands and bottomlands, often in unburned or rarely burned locations; abundant. 1143-1145.

*Vitis palmata* Vahl. Catbird grape. Uplands and bottomlands, often in unburned or rarely burned locations; abundant. 1415-1417.

*Vitis rotundifolia* Michx. Muscadine. Uplands and bottomlands, often in unburned or rarely burned locations; abundant. 778-780.

## Magnoliophyta: Lilliopeales

### Agavaceae – Century-Plant Family

*Manfreda virginica* (L.) Salisb. ex Rose. False aloe. RRB treatment plot of the PFHRA; rare. Photograph.

*Yucca glauca* Nutt. Soapweed yucca. Along rarely used roadways, often near creeks; rare. Photograph.

### Alismataceae – Water-Plantain Family

*Alisma subcordatum* Raf. American water plantain. In drainage that feeds the Kiamichi in an area grazed by cattle, under canopy of *Liquidambar styraciflua*; infrequent. 1661.

*Sagittaria graminea* Michx. Grassy arrowhead. In pond near the wildlife management area headquarters; rare. 895-897.

### Araceae – Arum Family

*Arisaema dracontium* (L.) Schott. Green dragon. Sandy bank of the Kiamichi River; rare. 1489.

### Commelinaceae – Spiderwort Family

*Commelina erecta* L. Whitemouth dayflower. Along Caney Creek under dense canopy of hardwood forest; rare. 967-969.

*Commelina virginica* L. Virginia dayflower. Along burned roadside, often in drainages; occasional. 1713-1715.

*Tradescantia ohiensis* Raf. Bluejacket. Burned areas or open pine-hardwood forests and all treatment plots of the PFHRA; frequent. 553-554, 649-650.

### Cyperaceae – Sedge Family

*Carex amphibola* Steud. Eastern narrowleaf sedge. Burned roadsides, and most treatment plots of the PFHRA; occasional. 648.

- Carex aureolensis* Steud. Burned roadsides, and most treatment plots of the PFHRA; occasional. 622-623.
- Carex blanda* Dewey. Eastern woodland sedge. Edge of pasture near Kiamichi River and pine hardwood forests; occasional. 1801.
- Carex bushii* Mackenzie. Bush's sedge. Disturbed roadsides, pine hardwood forests, and all treatment plots of the PFHRA; frequent. 527-528, 1306-1308, 1407, 1544.
- Carex crinita* Lam. Fringed sedge. Along edges of creeks and streams, often where water is murky; occasional. 1358-1360.
- Carex granularis* Muhl. ex. Willd. Limestone meadow sedge. Open, burned pine hardwood forests; occasional. 950-951.
- Carex leavenworthii* Dewey. Leavenworth's sedge. Along Caney Creek in bottomland area; occasional. 506-507.
- Carex lupuliformis* Sartwell ex Dewey. False hop sedge. Along edges of creeks and streams, often where water is murky; occasional. 1355-1357.
- Carex meadii* Dewey. Mead's sedge. Open roadsides; abundant. 502-503, 1224.
- Carex oklahomensis* Mackenzie. Oklahoma sedge. Rocky, muddy depression in glade; rare. 646-647, 1325.
- Carex oxylepis* Torr. & Hook. Sharpshale sedge. Along drainage that feeds the Kiamichi River, grazed area under dense canopy of *Liquidambar styraciflua*; rare. 504-505, 1794-1796.
- Carex reniformis* (Bailey) Small. Kidneyshaped sedge. Pine-hardwood forests; occasional. 1389-1391.
- Carex scoparia* Schkuhr ex Willd. Broom sedge. Along drainage that feeds the Kiamichi River, grazed area under dense canopy of *Acer rubrum*; rare. 1629.
- Carex socialis* Mohlenbrock & Schwegm. Low woodland sedge. Northwest facing hillside in dense hardwood forest; infrequent. 901-903, 1798-1800.
- Carex texensis* (Torr.) Bailey. Texas sedge. Bottomland near Caney Creek under dense hardwood canopy; infrequent. 1289.
- Cyperus echinatus* (L.) Wood. Globe flatsedge. Drainages and ditches along open roadsides, and the CCSP, HT1, and HT4 treatment plots of the PFHRA; frequent. 633-634, 743-744, 1394.

- Cyperus esculentus* L. Chufa flatsedge. Along drainages, often on northeast facing hillsides; occasional. 799-801.
- Cyperus lupulinus* (Spreng.) Marcks. Great Plains flatsedge. In the CCSP #12 treatment plot of the PFHRA on a southeast facing slope; rare. 1539.
- Dulichium arundinaceum* (L.) Britt. Threeway sedge. Rocky bed of Caney Creek, growing in standing water; rare. 1200-1202.
- Eleocharis quadrangulata* (Michx.) Roemer & J.A. Schultes. Squarestem spikerush. Rocky bed of Caney Creek, growing in standing water; rare. 1606-1608.
- Eleocharis rostellata* (Torr.) Torr. Beaked spikerush. In open, rocky drainage that feeds Caney Creek; rare. 1020-1022.
- Eleocharis tenuis* (Willd.) J.A. Schultes. Slender spikerush. Along creeks and drainages, in small wet depressions with direct sunlight, and in the HT1, HT2, and RRB treatment plots of the PFHRA; frequent. 475-476, 1237.
- Fimbristylis puberula* (Michx.) Vahl. Hairy fimbry. Rocky, muddy depression in glade; occasional. 1320-1322.
- Isolepis carinata* Hook. & Arn. ex Torr. Keeled bulrush. Open, burned glade; rare. 1002-1003.
- Rhynchospora corniculata* (Lam.) Gray. Shortbristle horned beaksedge. Open, rocky area along Caney Creek; rare. 1788-1790.
- Rhynchospora harveyi* W. Boott. Harvey's beaksedge. Annual burn treatments of the PFHRA; infrequent. 830-832.
- Scleria oligantha* Michx. Littlehead nutrush. Pine-hardwood forests, uplands, bottomlands, and all treatment plots of the PFHRA; abundant. 660-661, 1385.

#### Dioscoreaceae - Yam Family

- Dioscorea quaternata* J.F. Gmel. Fourleaf yam. Bottomland near the Kiamichi River under dense canopy of *Liquidambar styraciflua* and *Nyssa sylvatica*; rare. 1746-1748.

#### Iridaceae Iris Family

- Hypoxis hirsuta* (L.) Coville. Common goldstar. Burned roadsides and treatment plots of the PFHRA; frequent. 492-493, 1225-1226.



*Cyperus esculentus* L. Chufa flatsedge. Along drainages, often on northeast facing hillsides; occasional. 799-801.

*Cyperus lupulinus* (Spreng.) Marcks. Great Plains flatsedge. In the CCSP #12 treatment plot of the PFHRA on a southeast facing slope; rare. 1539.

*Dulichium arundinaceum* (L.) Britt. Threeway sedge. Rocky bed of Caney Creek, growing in standing water; rare. 1200-1202.

*Eleocharis quadrangulata* (Michx.) Roemer & J.A. Schultes. Squarestem spikerush. Rocky bed of Caney Creek, growing in standing water; rare. 1606-1608.

*Eleocharis rostellata* (Torr.) Torr. Beaked spikerush. In open, rocky drainage that feeds Caney Creek; rare. 1020-1022.

*Eleocharis tenuis* (Willd.) J.A. Schultes. Slender spikerush. Along creeks and drainages, in small wet depressions with direct sunlight, and in the HT1, HT2, and RRB treatment plots of the PFHRA; frequent. 475-476, 1237.

*Fimbristylis puberula* (Michx.) Vahl. Hairy fimbry. Rocky, muddy depression in glade; occasional. 1320-1322.

*Isolepis carinata* Hook. & Arn. ex Torr. Keeled bulrush. Open, burned glade; rare. 1002-1003.

*Rhynchospora corniculata* (Lam.) Gray. Shortbristle horned beaksedge. Open, rocky area along Caney Creek; rare. 1788-1790.

*Rhynchospora harveyi* W. Boott. Harvey's beaksedge. Annual burn treatments of the PFHRA; infrequent. 830-832.

*Scleria oligantha* Michx. Littlehead nutrush. Pine-hardwood forests, uplands, bottomlands, and all treatment plots of the PFHRA; abundant. 660-661, 1385.

#### Dioscoreaceae – Yam Family

*Dioscorea quaternata* J.F. Gmel. Fourleaf yam. Bottomland near the Kiamichi River under dense canopy of *Liquidambar styraciflua* and *Nyssa sylvatica*; rare. 1746-1748.

#### Iridaceae – Iris Family

*Hypoxis hirsuta* (L.) Coville. Common goldstar. Burned roadsides and treatment plots of the PFHRA; frequent. 492-493, 1225-1226.

*Sisyrinchium angustifolium* P. Mill. Narrowleaf blue-eyed grass. Open roadsides, pine-hardwood forests and the HT, HT4, and RRB treatment plots of the PFHRA; abundant. 539-540, 1238.

#### Juncaceae – Rush Family

*Juncus acuminatus* Michx. Tapertip rush. Moist drainages on northeast facing hillsides in pine-hardwood forests; infrequent. 639-640, 802-804.

*Juncus balticus* Willd. Baltic rush. Moist depression at base of southeast facing hillside in direct sunlight; rare. 1486.

*Juncus brachycarpus* Engelm. Whiteroot rush. Open burned areas and HT1 and HNT1 treatment plots of the PFHRA; infrequent. 777, 1408, 1593.

*Juncus coriaceus* Mackenzie. Leathery rush. Along drainages in open pine-hardwood forests; infrequent. 910-912.

*Juncus diffusissimus* Buckl. Slimpod rush. Roadside ditches and the HT1 treatment plots of the PFHRA; infrequent. 823-825, 1440.

*Juncus effusus* L. Common rush. Drainages in low-woods forests and the HT, HT1, and HNT1 treatment plots of the PFHRA; abundant. 624-625, 1324.

*Juncus marginatus* Rostk. Grassleaf rush. Drainages in open, frequently burned pine-hardwood forests; infrequent. 826-828.

*Juncus secundus* Beauv. ex Poir. Lopsided rush. Roadside ditches and the HT2 and HT3 treatment plots of the PFHRA; infrequent. 573-572.

*Juncus tenuis* Willd. Poverty rush. Roadside ditches and all treatment plots of the PFHRA except the annual burns; frequent. 1323, 1467-1469.

#### Liliaceae – Lily Family

*Allium canadense* L. Meadow garlic. Open pine-hardwood forests, burned roadsides, and all treatment plots of the PFHRA; abundant. 719-720, 1205-1207, 1316.

*Allium stellatum* Nutt. ex Ker-Gawl. Autumn onion. Disturbed roadsides and annual burn treatments of the PFHRA; frequent. 1025-1027.

*Camassia scilloides* (Raf.) Cory. Atlantic camas. Glades; rare. 1255, 1265, 1310.

*Nothoscordum bivalve* (L.) Britt. Crowpoison. Open pine-hardwood forests, burned roadsides, and all treatment plots of the PFHRA; abundant. 486-487, 1227.

#### Orchidaceae – Orchid Family

*Spiranthes cernua* (L.) L.C. Rich. Nodding ladies'-tresses. In openings of low-woods forest in bottomland near Caney Creek; rare. 1787.

#### Poaceae Grass Family

*Agrostis exarata* Trin. Spike bentgrass. Along Caney Creek under dense canopy of *Cornus florida*; infrequent. 1211-1213.

*Agrostis hyemalis* (Walt.) B.S.P. Winter bentgrass. Along disturbed roadside in sandy soil; frequent. 602-603, 739-740, 1516.

*Andropogon gerardii* Vitman. Big bluestem. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 961-963.

*Andropogon gyrans* Ashe. Elliott's bluestem. Rare. Collected by R. Masters.

*Anthoxanthum aristatum* Boiss. Annual vernalgrass. Along disturbed roadsides; frequent. 574-575, 1261.

*Aristida dichotoma* Michx. Churchmouse threeawn. Open, frequently burned sites; frequent. 1120-1122.

*Aristida oligantha* Michx. Prairie threeawn. Open, frequently burned sites; infrequent. 1041-1043.

*Aristida purpurascens* Poir. Arrowfeather threeawn. Open, frequently burned sites, and all burned treatment plots of the PFHRA; abundant. 955-957, 1123-1125.

*Arundinaria gigantea* (Walt.) Muhl. Giant cane. Floodplains of Caney Creek; rare. 1728-1730.

*Bothriochloa laguroides* (DC.) Herter. Silver beardgrass. Rare. Collected by R. Masters.

*Brachyelytrum erectum* (Schreb. ex Spreng.) Beauv. Bearded shorthusk. In deep drainage that feed the Kiamichi River under dense hardwood canopy; rare. 1763-1765.

*Bromus hordeaceus* L. Soft brome. Along edge of pine-hardwood forests; frequent. 598-599.

- Bromus pubescens* Muhl. ex Willd. Hairy woodland brome. Along edges of pine-hardwood forests and disturbed roadsides; occasional. 1381-1382, 1384.
- Bromus secalinus* L. Rye brome. Along less-disturbed roadsides, often in sandy soil; infrequent. 1374.
- Calamovilfa arcuata* K.E. Rogers. Cumberland sandreed. Burned, intermittent creek in open pine-hardwood forest; rare. 1791-1793.
- Chasmanthium latifolium* (Michx.) Yates. Indian woodoats. Bottomlands along creeks and drainages, often if moist soil; abundant. 811-813.
- Chasmanthium laxum* (L.) Yates. Slender woodoats. Bottomlands along creeks and drainages; infrequent. 858-860, 1581.
- Coelorachis cylindrica* (Michx.) Nash. Cylinder jointtail grass. Open, burned glade; frequent. 1475-1477.
- Dactylis glomerata* L. Orchardgrass. Along disturbed roadsides and edges of food plots; occasional. 604-605, 1442.
- Danthonia spicata* (L.) Beauv. ex Roemer & J.A. Schultes. Poverty oatgrass. Open pine-hardwood and hardwood forests; abundant. 606-607, 1337, 1340-1342.
- Dichantherium acuminatum* (Sw.) Gould & C.A. Clark. Tapered rosette grass. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 600-601, 655-656, 697-698.
- Dichantherium boscii* (Poir.) Gould & C.A. Clark. Bosc's panicgrass. Bottomlands along creeks and drainages, often if moist soil; infrequent. 585-586, 1332.
- Dichantherium depauperatum* (Muhl.) Gould. Starved panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 1028-1030, 1401.
- Dichantherium dichotomum* (L.) Gould. Cypress panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; frequent. 693-694, 1339, 1529.
- Dichantherium laxiflorum* (Lam.) Gould. Openflower rosette grass. Rocky pine-hardwood forest, often on northeast facing hillsides; infrequent. 874-876.
- Dichantherium oligosanthos* (J.A. Schultes) Gould. Heller's rosette grass. Along drainage in rocky glade; infrequent. 1302.

- Dichanthelium scoparium* (Lam.) Gould. Velvet panicum. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; infrequent. 731-732, 1527.
- Dichanthelium sphaerocarpon* (Ell.) Gould. Roundseed panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 695-696, 871-873, 1480-1482.
- Digitaria ischaemum* (Schreb.) Schreb. ex Muhl. Smooth crabgrass. Along open, disturbed roadsides; infrequent. 1155-1157.
- Digitaria sanguinalis* (L.) Scop. Hairy crabgrass. Along open, disturbed roadsides; infrequent. 916-918.
- Echinochloa crus-galli* (L.) Beauv. Barnyardgrass. Open disturbed or burned areas; occasional. 928-930.
- Elymus canadensis* L. Canada wildrye. Along disturbed roadsides and food plots; frequent. 670-671.
- Elymus virginicus* L. Virginia wildrye. Along disturbed roadsides and food plots; frequent. 1518.
- Eragrostis hirsuta* (Michx.) Nees. Bigtop lovegrass. Disturbed area along access road into lower campground; infrequent. 1149-1151.
- Eragrostis pilosa* (L.) Beauv. Indian lovegrass. Growing in disturbed roadside ditch in sandy soil; infrequent. 1044-1046.
- Festuca paradoxa* Desv. Clustered fescue. Along drainages and creeks in pine-hardwood forests; occasional. 1549-1551.
- Festuca subverticillata* (Pers.) Alexeev. Nodding fescue. On hillside near Peterson creek in open pine-hardwood forest; occasional. 768-769, 1334-1336.
- Gymnopogon ambiguus* (Michx.) B.S.P. Bearded skeletongrass. Opened, burned pine-hardwood forests, disturbed roadsides, and burned treatment plots of the PFHRA; frequent; abundant. 913-915.
- Hordeum pusillum* Nutt. Little barley. Along disturbed roadsides and food plots; occasional; occasional. 589-590, 1375.
- Leersia oryzoides* (L.) Sw. Rice cutgrass. Open bed of Caney Creek in standing water; rare. 1188-1190.

- Lolium arundinaceum* (Schreb.) S.J. Darbyshire. Tall fescue. Mixed-pine hardwood forests; Occasional. 657-658.
- Lolium perenne* L. Perennial ryegrass. Along disturbed roadsides and food plots; occasional. 596-597, 1354.
- Lolium pratense* (Huds.) S.J. Darbyshire. Meadow ryegrass. Open, disturbed areas; frequent. 1437-1439.
- Melica mutica* Walt. Twoflower melicgrass. Bottomlands along creeks and drainages, often if moist soil; infrequent. 1282.
- Muhlenbergia sobolifera* (Muhl. ex Willd.) Trin. Rock muhly. Opened, burned pine-hardwood forests, disturbed roadsides, and burned treatment plots of the PFHRA; frequent. 1010-1012, 1179-1181.
- Muhlenbergia sylvatica* Torr. ex Gray. Woodland muhly. Pine-hardwood forest along drainage; rare. 1708-1710.
- Panicum anceps* Michx. Beaked panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides; occasional. 836-838.
- Panicum brachyanthum* Steud. Prairie panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides; rare. 1004-1006.
- Panicum philadelphicum* Bernh. ex Trin. Philadelphia panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides; occasional. 944-946.
- Panicum rigidulum* Bosc ex Nees. Redtop panicgrass. Opened, burned pine-hardwood forests, disturbed roadsides; Rare. 1512-1515
- Panicum virgatum* L. Switchgrass. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 839-841, 952-954.
- Paspalum floridanum* Michx. Florida paspalum. Opened, burned pine-hardwood forests, disturbed roadsides; frequent. 845-847.
- Paspalum setaceum* Michx. Thin paspalum. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; frequent. 741-742, 1478.
- Piptochaetium avenaceum* (L.) Parodi. Blackseed spargrass. Along Divide Creek under dense canopy of *Pinus echinata* and *Carya texana*; rare. 1386-1388.
- Poa arida* Vasey. Plains bluegrass. Along power line right-of way; rare. 1464-1466.

- Saccharum breviflorum* (Michx.) Pers. Shortbeard plume grass. Floodplain along Caney Creek under partial shade of *Carya tomentosa*; rare. 1701-1703.
- Schizachyrium scoparium* (Michx.) Nash. Little bluestem. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 1133-1135, 1734-1736.
- Setaria parviflora* (Poir.) Kerguelen. Marsh bristlegrass. Opened, burned pine-hardwood forests, disturbed roadsides, and most burned treatment plots of the PFHRA; frequent. 594-595, 868-870, 1520.
- Sorghastrum nutans* (L.) Nash. Indiangrass. Opened, burned pine-hardwood forests, disturbed roadsides, and all treatment plots of the PFHRA; abundant. 1170-1172.
- Sorghum halepense* (L.) Pers. Johnson grass. Weedy along roadsides and food plots; abundant. 747-748, 1441.
- Sphenopholis obtusata* (Michx.) Scribn. Prairie wedgescale. Open, burned glades; frequent. 635-636.
- Steinchisma hians* (Ell.) Nash. Gaping grass. Along disturbed access roads in the PFHRA; occasional. 947-949, 1007-1009, 1597.
- Tridens flavus* (L.) A.S. Hitchc. Purpletop tridens. Open, pine hardwood forests and the CONT, CCSP, and RRB treatment plots of the PFHRA; occasional. 941-943.
- Tridens strictus* (Nutt.) Nash. Longspike tridens. Along grown-over access roads at edge of woods; occasional. 919-921.
- Tripsacum dactyloides* (L.) L. Eastern gamagrass. Bottomlands near creeks, usually in canopy openings; occasional. 1026-1027, 1395.
- Vulpia myuros* (L.) K.C. Gmel. Rat-tail fescue. Along disturbed roadsides, often in sandy soil; frequent. 689-690, 1515.

#### Smilacaceae -- Greenbrier Family

- Smilax bona-nox* L. Saw greenbrier. Unburned pine-hardwood and low-woods forests and all treatment plots of the PFHRA, often forming thickets; abundant. 861-863, 1065-1067.
- Smilax smallii* Morong. Lanceleaf greenbrier. Bottomland near the Kiamichi River under dense canopy of *Liquidambar styraciflua* and *Nyssa sylvatica*; rare. 1755-1757.

Typhaceae – Cat-tail Family

*Typha angustifolia* L. Narrowleaf cattail. Dense in some stagnant ponds: infrequent.  
1669-1671.

Xyridaceae - Yellow-eyed Grass Family

*Xyris difformis* Chapman. Bog yelloweyed grass. Rocky edge of Caney Creek in direct  
sunlight; rare. 1111-1113.



## APPENDIX C

LIST OF PLANT TAXA ENCOUNTERED IN 20 X 50 M WHITTAKER PLOTS IN THE PUSHMATAHA FOREST HABITAT RESEARCH AREA. THE NUMBER INDICATES THE SUM OF THE RELATIVE ABUNDANCE FOR EACH TAXON PRESENT IN AREAS WITH THE CORRESPONDING TREATMENT. NOMENCLATURE AND FOLLOWS THAT OF THE PLANTS DATABASE (USDA, NRCS 1999). SEE TABLE 1 FOR THE DEFINITION OF EACH ACRONYM.

SPECIES NAME	TREATMENT									
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Acalypha gracilens</i>	2.13	3.13	1.50	3.38	2.88	2.38	2.25	4.38	1.13	1.25
<i>Acer rubrum</i>	0.75		0.13							0.63
<i>Achillea millefolium</i>				1.00	1.00					
<i>Ageratina altissima</i>		0.63				0.75			0.63	
<i>Agrostis hyemalis</i>		0.25		1.00	1.00	0.13	0.38	1.38		0.25
<i>Allium canadense</i>			0.75	1.38	1.00			1.50		0.25
<i>Ambrosia artemisiifolia</i>		0.25			0.13	0.63	0.13	1.38		
<i>Ambrosia bidentata</i>					0.50		0.50	0.50		
<i>Amelanchier arborea</i>	2.88	1.75	0.25			0.13				1.25
<i>Ammoselinum popei</i>		1.00			0.13	0.25				
<i>Amphicarpaea bracteata</i>	1.13	1.00					1.00	0.25		0.13
<i>Anagallis minima</i>		1.00	0.75	4.50	4.25	3.00	3.50	3.88	1.50	0.63
<i>Andropogon gerardii</i>	3.88	8.75	3.38	64.75	15.75	11.38	12.38	29.00	8.88	8.63
<i>Andropogon virginicus</i>	0.88	4.50	1.50	1.88	1.38	3.75	4.38	1.75	0.75	2.00
<i>Antennaria parlinii</i>	2.63	1.38	2.13	1.88	2.88	1.50	2.50	3.25	1.50	4.25

SPECIES NAME CONT...	TREATMENT									
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HN1	PBS	RRB
<i>Aristida purpurascens</i>		1.13		0.75	1.38	0.25	0.75	1.13	0.13	1.25
<i>Arnoglossum plantagineum</i>				1.38	0.75		0.75	1.00	0.75	0.50
<i>Asclepias hirtella</i>	0.88	0.88	1.00	0.75	0.88	1.00	1.00	1.00	0.13	2.25
<i>Asclepias tuberosa</i>							1.00		0.63	
<i>Asclepias variegata</i>	2.00									0.13
<i>Asclepias verticillatu</i>			0.63							
<i>Asplenium platyneuron</i>	0.38	1.13	0.63				1.00			
<i>Baptisia bracteata</i>	2.75	0.38	1.63	2.38	1.63	1.00	2.00	2.38	0.38	2.88
<i>Berchemia scandens</i>			0.38							
<i>Brachyelytrum erectum</i>										0.75
<i>Bromus hordeaceus</i>		0.25								
<i>Callicarpa americana</i>	2.63	6.88	6.75	1.00	3.75	4.75	2.38	1.63	1.63	3.38
<i>Callirhoe digitata</i>							0.50			
<i>Campsis radicans</i>			1.00							
<i>Carex amphibola</i>	1.13		0.88	0.13	1.00		0.13			0.63
<i>Carex bushii</i>	3.00	1.38	0.88	1.00	2.88	1.75	1.75	1.50	0.38	3.13
<i>Carex scoparia</i>		1.13		2.13				1.75		
<i>Carex socialis</i>		0.13	0.25					0.13		
<i>Carex sp.</i>	0.88	2.75	0.50	3.25	3.25	1.75	1.63	3.88	1.13	1.63
<i>Carex texensis</i>	2.63	2.88	1.25			3.88				1.25
<i>Carya alba</i>						0.75	0.75			0.63
<i>Carya texana</i>	5.13	7.63	3.38	3.88	6.75	3.13	7.50	5.13	5.38	6.38

SPECIES NAME CONT...	TREATMENT									
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Ceanothus herbaceus</i>				0.63						
<i>Chamaecrista fasciculata</i>		1.00			1.00		1.00	3.50		1.00
<i>Chasmanthium latifolium</i>					0.63					1.13
<i>Cirsium altissimum</i>	0.63	1.00	0.13							2.13
<i>Cirsium carolinianum</i>	1.88	13.88	1.25	2.88	4.38	2.00	2.63	2.75	2.25	4.50
<i>Clitoria mariana</i>	0.25	1.63	0.13	0.25	1.63	1.88	0.38	0.13		
<i>Conyza canadensis</i>		0.05								
<i>Coreopsis grandiflora</i>	1.50	2.75	0.88	4.00	3.75	3.50	4.38	4.50	1.63	1.38
<i>Cornus florida</i>				1.88	1.00		1.38	1.13	0.75	
<i>Crotalaria sagittalis</i>				2.00	0.13		1.13	0.75		
<i>Croton monanthogynus</i>	0.13	5.25	0.88	2.00	0.38	0.13	3.50	3.38	0.38	1.13
<i>Croton willdenowii</i>		0.13		0.88				0.75	0.75	
<i>Cuscuta pentagonu</i>	0.63	2.00		3.88	2.63	0.88	2.38	2.50	1.63	2.63
<i>Cyperus echinatus</i>		0.25		0.88			0.13			
<i>Cyperus esculentus</i>				0.50						
<i>Cyperus lupulinus</i>	3.63		1.75		1.25		1.25	0.13		2.38
<i>Danthonia spicata</i>	0.75	0.75	1.75	0.63	1.25	0.38	1.75	1.88	1.00	0.63
<i>Desmodium canadense</i>		1.38		1.38	1.38		0.75	0.13	0.88	0.63
<i>Desmodium ciliare</i>										0.75
<i>Desmodium paniculatum</i>	0.75	1.88	1.13	3.00	3.75	0.63	3.00	2.50	0.13	3.50
<i>Desmodium sessilifolium</i>						0.38				
<i>Desmodium viridiflorum</i>	2.00	0.88	0.13	1.63	3.38	1.50	2.50	2.38	0.25	2.75

SPECIES NAME CONT...	TREATMENT									
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Dichanthelium acuminatum</i>	2.00	0.88	0.13	1.38	0.50	0.75	1.50	1.88	0.38	3.63
<i>Dichanthelium boscii</i>	2.63	0.50			1.13	1.13	1.00			3.75
<i>Dichanthelium commutatum</i>	1.75	5.00	2.38	3.75	4.38	2.75	2.88	2.13	0.75	4.00
<i>Dichanthelium depauperatum</i>	2.50	1.38	2.75	0.25	1.63	1.38	2.25	1.38	0.50	5.50
<i>Dichanthelium dichotomum</i>	2.13	2.88	2.63				0.50	0.50		5.88
<i>Dichanthelium laxiflorum</i>	0.25	0.75			0.38				0.38	0.63
<i>Dichanthelium ravenelii</i>		1.00								
<i>Dichanthelium sphaerocarpon</i>	0.38	5.00	1.00	5.38	8.88	3.88	4.50	6.50	1.75	0.50
<i>Diodia teres</i>				1.50				0.75		
<i>Echinacea pallida</i>	0.13	1.63	0.13	3.63	3.00	2.88	2.38	4.25	1.25	1.38
<i>Echinochloa crus-galli</i>	0.13	0.63	0.13	0.25	0.25	0.25	0.25	0.50		0.63
<i>Eleoagnus umbellata</i>	1.25	1.13	0.63				1.00			
<i>Eleocharis tenuis</i>				1.25	0.13					0.13
<i>Elymus canadensis</i>	2.38	3.50	2.00	0.50	1.25	1.50	1.13	0.75	0.38	1.00
<i>Erechtites hieracifolia</i>	0.13	1.38	0.38	0.75		2.00			0.13	0.50
<i>Erigeron strigosus</i>	1.13	2.13	0.75	3.63	4.38	3.00	3.75	3.50	1.50	2.25
<i>Eryngium yuccifolium</i>	0.50	0.50	0.88	4.38	2.25	0.13	0.75	2.88	1.00	1.00
<i>Eupatorium capillifolium</i>		0.13								
<i>Eupatorium perfoliatum</i>	0.38	0.75	0.50		1.38	1.00	1.38	0.75	0.13	
<i>Euphorbia tetrapora</i>	0.13									
<i>Eurybia paludosa</i>	0.63		0.88	1.63	2.88		1.25	2.25	1.25	1.63
<i>Fimbristylis puberula</i>				0.13				0.13		

SPECIES NAME CONT...	TREATMENT										
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB	
<i>Galactia regularis</i>	2.00	3.38	3.00	3.50	3.75	2.75	3.75	4.25	2.00	2.75	
<i>Galium obtusum</i>										0.13	
<i>Galium pilosum</i>		1.38	1.38		0.38	0.25	0.63			0.50	
<i>Gamochaeta purpurea</i>		0.75		0.50	0.13	0.13	0.63	0.38			
<i>Geranium carolinianum</i>							0.13				
<i>Geranium pusillum</i>		1.00					1.75				
<i>Gymnopogon ambiguus</i>	0.50	1.00		0.38	1.63	1.50	2.00	1.50	0.75	2.13	
<i>Helenium flexuosum</i>		0.50									
<i>Helianthus hirsutus</i>	0.50	1.13	0.38	5.25	4.00	1.88	2.63	4.38	1.50	2.25	
<i>Hieracium gronovii</i>	1.88	0.50	1.00		0.75		1.25	1.63		3.00	
<i>Hordeum pusillum</i>		0.63		1.00	0.75	0.75	0.50	1.75			
<i>Houstonia longifolia</i>	0.75				0.25		0.75			0.50	
<i>Hypericum drummondii</i>		1.75		2.88	0.75	1.00	1.63	4.50	0.50	0.25	
<i>Hypericum hypericoides</i>	1.25	0.63	1.13		0.63	0.50	0.75			0.88	
<i>Juncus brachycarpus</i>				1.88				0.75			
<i>Juncus diffusissimus</i>				0.50							
<i>Juncus effusus</i>			0.88	1.63				2.75			
<i>Juncus secundus</i>					1.38	0.25					
<i>Juncus tenuis</i>	0.75	0.25			0.38	1.25	1.75			0.25	
<i>Juniperus virginiana</i>	3.13		2.50								
<i>Lactuca canadensis</i>		0.88		0.13			0.13			1.25	
<i>Lechea tenuifolia</i>		0.50		4.88	2.63	1.88	1.50	5.13	0.75	0.50	



SPECIES NAME CONT...	TREATMENT										
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB	
<i>Oxalis stricta</i>	1.13									0.88	
<i>Oxalis violacea</i>	0.13	2.25	1.38	1.25	2.38	2.75	2.00	1.88		0.88	
<i>Packera aurea</i>			0.50								
<i>Panicum anceps</i>			0.38					0.75			
<i>Panicum brachyanthum</i>				1.00				1.00			
<i>Panicum philadelphicum</i>				3.00	0.88	1.00	0.13	1.88	0.50		
<i>Panicum sp.</i>							0.13				
<i>Panicum virgatum</i>								0.50			
<i>Parietaria pensylvanica</i>			0.38		1.00						
<i>Parthenocissus quinquefolia</i>	5.50	1.88	5.25	1.50	1.38	0.50	1.75	1.00	0.38	4.25	
<i>Paspalum floridanum</i>				0.75							
<i>Paspalum setaceum</i>		0.13		1.00	0.25	0.63		1.50			
<i>Pedicularis canadensis</i>								3.50			
<i>Penstemon digitalis</i>		0.13		0.88	0.25						
<i>Penstemon laxiflorus</i>					0.38						
<i>Phlox pilosa</i>	0.63	0.75		0.75	1.25	0.88	0.88	2.38	1.13	0.38	
<i>Physalis hederifolia</i>	1.75	1.13	0.25	1.25	1.38	2.00	1.75	1.13	1.50	1.38	
<i>Pinus echinata</i>	2.75	0.50	1.75	3.38	4.13	1.25	3.38	3.25	0.63	2.63	
<i>Pinus taeda</i>		2.25									
<i>Pityopsis graminifolia</i>	0.38	1.38	0.50		0.75	1.13	2.00	0.75		1.88	
<i>Plantago aristata</i>		1.00		2.00	0.50	0.50	0.25	1.38			
<i>Plantago virginica</i>		1.00		0.63	0.75		0.25	0.88			

SPECIES NAME	CONT...	TREATMENT									
		CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Polygala alba</i>			1.25		4.50	4.63	2.75	2.38	5.50	1.50	1.38
<i>Polygala incarnata</i>						0.38	1.00		1.00	1.00	
<i>Polygala sanguinea</i>					1.88				1.88		
<i>Polygonum hydropiperoides</i>					0.38						
<i>Potentilla simplex</i>			0.13			1.50					
<i>Primella vulgaris</i>						0.25		0.13			0.38
<i>Prunus serotina</i>	0.88	0.50	0.25		0.13			1.63			0.88
<i>Pseudognaphalium obtusifolium</i>	0.13	1.13	0.63	1.25	1.75	2.38	1.13	1.13	0.75	1.88	
<i>Psoralidium tenuiflorum</i>			0.13	2.50	1.00				3.38	1.25	
<i>Ptilimnium nuttallii</i>		4.00		2.63	2.00	2.13	1.13	3.38			1.00
<i>Pycnanthemum tenuifolium</i>		1.25	1.50	2.13	3.13	0.50	0.75	2.25	1.00	1.13	
<i>Pyrrhopappus carolinianus</i>		1.13		0.13		1.50		0.25			
<i>Pyrrhopappus grandiflorus</i>		0.25									
<i>Quercus marilandica</i>	4.63	2.13	5.63	0.75	3.63	3.75	5.13	1.75	0.63	5.88	
<i>Quercus nigra</i>	2.00	1.38									1.13
<i>Quercus stellata</i>	5.88	6.50	8.38	11.13	9.75	11.63	14.88	8.38	2.88	6.38	
<i>Quercus velutina</i>	2.63	5.50	1.75	5.13	3.88	0.75	3.38	6.63	4.25	5.25	
<i>Ranunculus fascicularis</i>					0.13			0.38			
<i>Rhus copallina</i>	0.50	31.38	0.50	37.50	16.25	41.25	24.50	6.38	0.75	1.25	
<i>Rhus glabra</i>		0.50	0.50	1.00	0.75	1.25	0.88				
<i>Ribes cynosbati</i>	0.75			0.75				0.13			1.00
<i>Rosa carolina</i>	0.38				0.38						



SPECIES NAME	CONT...	TREATMENT									
		CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Rubus occidentalis</i>		2.00	3.50	2.88	1.75	3.38	5.88	4.63	1.88	0.38	2.25
<i>Rudbeckia grandiflora</i>					0.38	0.63	0.50		0.50	0.38	0.88
<i>Rudbeckia hirta</i>			2.13		4.38	5.38	3.00	3.13	4.50	1.50	1.63
<i>Ruellia pedunculata</i>			2.13		1.00	0.50	0.63				
<i>Sabatia campestris</i>								0.50			
<i>Sanicula canadensis</i>				0.63							
<i>Schizachyrium scoparium</i>		6.88	64.88	5.38	330.63	142.38	50.50	138.50	337.50	125.00	18.25
<i>Scleria oligantha</i>		2.75	2.75	2.75	4.75	3.63	2.13	2.88	4.38	1.50	3.50
<i>Scutellaria ovata</i>		1.75	3.88	0.63	3.13	2.88	1.00	2.88	2.75	1.00	2.38
<i>Setaria parviflora</i>			2.00		1.38	0.88	0.88	1.50	1.50	0.75	
<i>Silphium laciniatum</i>						0.38					
<i>Sisyrinchium angustifolium</i>				0.13				0.63			0.88
<i>Smilax bona-nox</i>		2.88	2.13	3.00	2.13	1.50	2.25	3.75	1.50	0.75	1.88
<i>Smilax rotundifolia</i>		0.50	1.00								
<i>Solanum carolinense</i>			3.13	0.88	1.00	0.75	0.38	0.75	0.75	0.38	0.25
<i>Solidago petiolaris</i>					2.63				1.63	0.63	
<i>Solidago radula</i>					0.25						
<i>Solidago ulmifolia</i>		1.75	0.25	0.38	3.75	5.13	1.25	3.25	6.13	0.63	3.75
<i>Sorghastrum nutans</i>					4.13	0.63	0.88	3.25	2.38	1.75	1.25
<i>Sorghum halepense</i>						1.63		0.13			
<i>Spermolepis divaricata</i>			0.63		0.13		2.75	1.50			
<i>Sphenopholis obtusata</i>					0.25			0.63	0.75		

SPECIES NAME	CONT...	TREATMENT									
		CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Polygala alba</i>			1.25		4.50	4.63	2.75	2.38	5.50	1.50	1.38
<i>Polygala incarnata</i>						0.38	1.00		1.00	1.00	
<i>Polygala sanguinea</i>					1.88				1.88		
<i>Polygonum hydropiperoides</i>					0.38						
<i>Potentilla simplex</i>			0.13			1.50					
<i>Prunella vulgaris</i>						0.25		0.13			0.38
<i>Prunus serotina</i>	0.88	0.50	0.25		0.13			1.63			0.88
<i>Pseudognaphalium obtusifolium</i>	0.13	1.13	0.63	1.25	1.75	2.38	1.13	1.13	0.75	1.88	
<i>Psoralidium tenuiflorum</i>			0.13	2.50	1.00				3.38	1.25	
<i>Ptilimnium nuttallii</i>		4.00		2.63	2.00	2.13	1.13	3.38		1.00	
<i>Pycnanthemum tenuifolium</i>		1.25	1.50	2.13	3.13	0.50	0.75	2.25	1.00	1.13	
<i>Pyrrhopappus carolinianus</i>		1.13		0.13		1.50		0.25			
<i>Pyrrhopappus grandiflorus</i>		0.25									
<i>Quercus marilandica</i>	4.63	2.13	5.63	0.75	3.63	3.75	5.13	1.75	0.63	5.88	
<i>Quercus nigra</i>	2.00	1.38								1.13	
<i>Quercus stellata</i>	5.88	6.50	8.38	11.13	9.75	11.63	14.88	8.38	2.88	6.38	
<i>Quercus velutina</i>	2.63	5.50	1.75	5.13	3.88	0.75	3.38	6.63	4.25	5.25	
<i>Ranunculus fascicularis</i>					0.13			0.38			
<i>Rhus copallina</i>	0.50	31.38	0.50	37.50	16.25	41.25	24.50	6.38	0.75	1.25	
<i>Rhus glabra</i>		0.50	0.50	1.00	0.75	1.25	0.88				
<i>Ribes cynosbati</i>	0.75			0.75				0.13		1.00	
<i>Rosa carolina</i>	0.38				0.38						

SPECIES NAME CONT...	TREATMENT										
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB	
<i>Rubus occidentalis</i>	2.00	3.50	2.88	1.75	3.38	5.88	4.63	1.88	0.38	2.25	
<i>Rudbeckia grandiflora</i>				0.38	0.63	0.50		0.50	0.38	0.88	
<i>Rudbeckia hirta</i>		2.13		4.38	5.38	3.00	3.13	4.50	1.50	1.63	
<i>Ruellia pedunculata</i>		2.13		1.00	0.50	0.63					
<i>Sabatia campestris</i>							0.50				
<i>Sanicula canadensis</i>			0.63								
<i>Schizachyrium scoparium</i>	6.88	64.88	5.38	330.63	142.38	50.50	138.50	337.50	125.00	18.25	
<i>Scleria oligantha</i>	2.75	2.75	2.75	4.75	3.63	2.13	2.88	4.38	1.50	3.50	
<i>Scutellaria ovata</i>	1.75	3.88	0.63	3.13	2.88	1.00	2.88	2.75	1.00	2.38	
<i>Setaria parviflora</i>		2.00		1.38	0.88	0.88	1.50	1.50	0.75		
<i>Silphium laciniatum</i>					0.38						
<i>Sisyrinchium angustifolium</i>			0.13				0.63			0.88	
<i>Smilax bona-nox</i>	2.88	2.13	3.00	2.13	1.50	2.25	3.75	1.50	0.75	1.88	
<i>Smilax rotundifolia</i>	0.50	1.00									
<i>Solanum carolinense</i>		3.13	0.88	1.00	0.75	0.38	0.75	0.75	0.38	0.25	
<i>Solidago petiolaris</i>				2.63				1.63	0.63		
<i>Solidago radula</i>				0.25							
<i>Solidago ulmifolia</i>	1.75	0.25	0.38	3.75	5.13	1.25	3.25	6.13	0.63	3.75	
<i>Sorghastrum nutans</i>				4.13	0.63	0.88	3.25	2.38	1.75	1.25	
<i>Sorghum halepense</i>					1.63		0.13				
<i>Spermolepis divaricata</i>		0.63		0.13		2.75	1.50				
<i>Sphenopholis obtusata</i>				0.25			0.63	0.75			

SPECIES NAME CONT...	TREATMENT									
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Strophostyles helvula</i>	0.13									
<i>Strophostyles umbellata</i>		2.00	1.25	4.00	6.38	3.63	3.38	4.13	1.00	3.38
<i>Stylosanthes biflora</i>	0.75	1.25	1.38	5.88	4.13	1.75	4.25	4.50	1.13	3.25
<i>Symphoricarpos orbiculatus</i>	1.13	1.88	2.13							1.00
<i>Symphyotrichum anomalum</i>	0.88		0.13	1.25	2.00		1.38	2.38	0.75	0.38
<i>Symphyotrichum cordifolium</i>										0.13
<i>Symphyotrichum lateriflorum</i>										0.63
<i>Symphyotrichum patens</i>	2.13	0.75	1.63	3.00	3.63	2.13	3.00	4.13	1.63	2.75
<i>Talinum parviflorum</i>				0.25				0.25	0.13	
<i>Tephrosia virginiana</i>	3.00	2.38	1.63	2.50	1.50	3.13	0.38	4.88	1.00	2.38
<i>Thaspium trifoliatum</i>	0.63			1.25	1.13			0.75		
<i>Toxicodendron radicans</i>	7.00	6.88	10.63	1.88	2.38	0.25	2.63	1.38	0.25	4.63
<i>Tradescantia ohiensis</i>	0.50	1.38	0.75	4.13	2.13	1.88	1.25	4.25	1.50	0.88
<i>Tridens flavus</i>	1.00						0.63			1.13
<i>Triodanis perfoliata</i>		1.88		1.25	1.13	2.50	0.88	1.13	0.13	
<i>Ulmus alata</i>	5.00	3.88	2.00	2.00	3.75	2.00	3.88	1.50	0.75	4.25
<i>Vaccinium arboreum</i>	2.38	2.38	2.25	3.13	5.38	2.63	2.25	2.38		6.13
<i>Vaccinium pullidum</i>							0.13			
<i>Vaccinium stamineum</i>		0.75			1.00					1.00
<i>Valerianella radiata</i>		0.88			0.25					
<i>Verbascum thapsus</i>								0.13		
<i>Verbesina helianthoides</i>							0.13	1.00		

SPECIES NAME CONT...	TREATMENT									
	CONT	CCSP	HT	HT1	HT2	HT3	HT4	HNT1	PBS	RRB
<i>Vernonia haldwinii</i>					0.25		0.13	0.13		0.13
<i>Vernonia lettermannii</i>					1.00					0.25
<i>Vicia villosa</i>					0.25					
<i>Viola pedata</i>	0.25	0.13	0.13	0.13	2.25	0.50	0.38	1.88		1.75
<i>Viola sororia</i>	0.38		0.25	0.25						1.50
<i>Vitis palmata</i>	2.13	3.25	1.00		2.63	1.38	2.88		0.50	1.25
<i>Vitis rotundifolia</i>	4.50	2.25	4.38	1.38	0.50	0.50	2.25	1.00		3.38
<i>Woodsia obtusa</i>		0.38	1.00							



VITA

Raelene M Crandall

Candidate for the Degree of

Master of Science

**Thesis:** VEGETATION OF THE PUSHMATAHA WILDLIFE MANAGEMENT AREA, PUSHAMATAHA COUNTY, OKLAHOMA

**Major Field:** Botany

**Biographical:**

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