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UPLAND FOREST VEGETATION OF THE OZARK MOUNTAINS IN NORTHWESTERN ARKANSAS

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ABSTRACT. Quantitative data on structure and composition of all strata of vegetation were collected from 20 study sites in the Boston Mountains Subsection of the Ozark Mountains of northwestern Arkansas in June 2004. All study sites were located at upper slope or ridgetop positions and occurred at elevations > 457 m. Oaks (*Quercus* spp.) were dominants in the tree stratum (stems ≥ 10 cm DBH) for all 11 sites located < 549 m but in only one site > 590 m. In these higher elevation sites, various other species, including sugar maple (*Acer saccharum*), were relatively more important. Hickories (*Carya* spp.) were consistently present but usually achieved dominant or codominant status only at higher elevations. Dogwood (*Cornus florida*) and red maple (*A. rubrum*) were the two most important species represented in the small tree (stems ≥ 2.5 cm but < 10 cm DBH) stratum. The Ozark data set was compared with data obtained from a series of topographically similar study sites in the central Appalachian Mountains of eastern central West Virginia. For the tree stratum, the two regions shared 15 species in common, but these were usually quite different in importance. Oaks were relatively more important in the Ozarks but typically were underrepresented in the small tree, sapling, and seedling strata in both regions.

Key Words: Appalachians, forest ecology, Ozarks, vegetation

Upland forest vegetation of the central and southern Appalachians has been the subject of numerous papers (e.g., Adams and Stephenson 1983; Golden 1981; Rheinhardt and Ware 1984; Stephenson 1982; Stephenson et al. 1993; Whittaker 1956) but much less information is available on the upland forests of most regions of the Ozark Mountains. Primary objectives of the research

described herein were first to characterize the upland forests of one region of the Ozarks in northwestern Arkansas and then to compare these forests with the upland forests from topographically similar study sites located within the Fernow Experimental Forest and adjacent areas of the Otter Creek Wilderness in West Virginia. These data were available as a result of previous studies (Muzika et al. 1999; Stephenson and Adams, unpubl. data). We hypothesized that these two regions would be different compositionally because of differences in soils and the somewhat warmer and drier climate of northwestern Arkansas. More specifically, we anticipated a greater proportion of oaks for all strata in the latter region.

The general study area (35°41.5′N to 35°47.6′N, 93°57.3′W to 94°00.3′W) is part of the Ozark National Forest and falls within the Boston Mountain Subdivision of the Ozark Mountain Natural Division (*sensu* Foti 1974) in northern Crawford, northwestern Franklin, and southeastern Washington counties in northwestern Arkansas. This is a region of low mountains, with maximum elevations ranging from 300 to 820 m. These mountains are capped by resistant Pennsylvanian sandstone underlain by interbedded sandstone and shale. Side slopes generally range from 3 to 50 percent inclination but sometimes exceed 70 percent. Soils at higher elevations are well drained, often rather stony, and have a surface layer consisting of fine sandy loam, gravelly fine sandy loam, or stony fine sandy loam. The climate of northwestern Arkansas is humid and continental. Records compiled for Crawford County indicate an average daily minimum temperature of 5°C in winter and an average daily maximum temperature in summer of 33°C. Mean annual precipitation is approximately 125 cm (Garner and Cox 1979). Presettlement forests at higher elevations in this portion of Arkansas appear to have been dominated by various species of *Quercus* (oak), with *Carya* spp. (hickory) also consistently present on most sites (Foti 2004).

The forest communities sampled in the present study fall within the Interior Highlands Section of the Oak-Hickory Forest region as described by Braun (1950). The physiographic province represented by the Interior Highlands is an ancient land form with a geological history similar to that of the Appalachians but separated from the latter by at least 800 km. However, similarities in the forest vegetation of the two regions have long been recognized. For example, Braun (1950) suggested that the relic mixed mesophytic communities found on the most mesic sites in the Boston

Mountains portion of the Interior Highlands were closely related to those of the Appalachians, with many species shared in common. The prevailing forests of both the Interior Highlands and large areas of the Appalachians are composed primarily of oaks, with hickories also important in some instances (Braun 1950; Stephenson et al. 1993). Indeed, the Central Hardwood Region as defined by most authors (e.g., Hicks 1998) actually extends from the Ozarks to the Appalachians. However, we are not aware of any previous study in which the forests characteristic of a particular type of topographic situation in the two regions have been examined in detail. As a result of a study carried out by the first two authors in one region of the central Appalachians, an extensive set of vegetation data was available for a series of study sites topographically similar to those sampled in the present study. These data served as the basis for a comparison of the structure and composition of upland forest communities in the Ozarks and the central Appalachians.

MATERIALS AND METHODS

In June of 2004, quantitative data on the structure and composition of all strata of vegetation were collected using standard sampling methods (e.g., Stephenson and Adams 1986) from 20 study sites in the Boston Mountains Subsection of the Ozarks of northwestern Arkansas. Potential study sites were identified from topographic maps, aerial photographs and information supplied by individuals (primarily foresters) who were familiar with the general study area. The sites actually sampled were subjectively selected to represent relatively undisturbed examples of the types of forest communities typically occurring at upper slope and ridgetop positions and at elevations > 457 m. All live trees [stems ≥ 2.5 cm diameter at breast height (DBH)] were measured and recorded by species in a single 20 m by 50 m (0.1 ha) quadrat in each study site. Stems ≥ 10 cm DBH were considered trees, whereas stems < 10 cm but ≥ 2.5 cm DBH were recorded as small trees. Quadrats were typically placed with their long axes parallel to the contour of the slope. Saplings (individuals of tree species < 2.5 cm DBH but ≥ 1.0 m tall) were tallied by species in the same quadrat. Numbers of large seedlings (individuals of tree species ≥ 10 cm but < 1.0 m tall) and shrubs (including woody vines) were recorded by species in four 5.0 by 5.0 m plots placed at regular

intervals along a 50 m tape used to establish the centerline of the 0.1 ha quadrat. Numbers of small seedlings (individuals of tree species < 10 cm tall) and estimates of percent cover of herbaceous plants, exposed rock, coarse woody debris, and bryophytes were recorded from ten 1.0 by 1.0 m plots placed at 5.0 m intervals along the same tape. All cover values were estimated using a cover class rating scale described by Daubenmire (1968). After all sampling had been completed, a complete tally was made of all species of vascular plants present in the entire 0.1 ha quadrat.

Topographic features recorded for each study site included slope position (upper slope or ridgetop), inclination (percent), aspect (degrees), and elevation (m). Slope inclination and aspect were recorded at three locations (both ends and the middle of the centerline) at each site. Elevation was determined using an aneroid altimeter in conjunction with 7.5 minute series topographic maps. Each of the 20 study sites was permanently marked, with coordinates determined by a portable geographic positioning system receiver.

Increment growth cores were extracted at breast height from three dominant or codominant trees in and around each quadrat for age determination. Cores were processed and growth rings were counted. Composite soil samples were collected from the upper 10 cm in each quadrat. Percent organic matter and pH were determined and the content in parts per million (ppm) for calcium, magnesium, potassium, phosphorus, manganese, sodium, zinc, sulfur, and total exchange capacity were measured by a commercial soils laboratory (Brookside Laboratories, Ohio).

Field data from each study site were used to calculate absolute (n/ha) and relative (%) density and absolute (m^2/ha) and relative (%) basal area values for trees and small trees. Importance value (IV) indices then were calculated for all species in these two strata as one-half the sum of relative basal area and relative density (Curtis and McIntosh 1951). Only relative density values were derived for saplings, large seedlings, small seedlings, and shrubs. Relative cover and relative frequency were determined for herbaceous plants. Nomenclature follows that of Kartesz (1994).

The Fernow Experimental Forest (39°03′N, 79°41′W) is located in eastern central West Virginia, which is within the Unglaciated Allegheny Plateau Region of the Appalachian Mountains (Fenneman 1938). Elevations within the Fernow range from 533 to 1112 m, and the topography is rugged, with moderate to steep

slopes (10 to 60 percent) common. Precipitation averages 145 cm per year and is evenly distributed throughout the year. Records compiled for the Town of Parsons indicate an average daily minimum temperature of −5°C in winter and an average daily maximum temperature in summer of 26°C (U.S.D.A. Forest Service 1987). As such, the Fernow is characterized by lower temperatures and higher precipitation than the Ozarks. The Fernow falls within the Mixed Mesophytic Forest Region as delimited by Braun (1950), but oaks are the most common species and are found on all sites along with *Fagus grandifolia* (American beech) and *Betula lenta* (sweet birch). The most mesic sites support primarily *Quercus rubra* (red oak), *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (yellow-poplar), *Prunus serotina* (black cherry), *Fraxinus americana* (white ash), and *Tilia americana* (basswood). Less mesic sites usually support oak communities composed of *Q. rubra, Q. alba* (white oak), *Q. prinus* (chestnut oak), and *Q. coccinea* (scarlet oak). *Acer rubrum* (red maple), *B. lenta, Nyssa sylvatica* (blackgum), *Sassafras albidum* (sassafras), and *Oxydendrum arboreum* (sourwood) also commonly occur on such sites (U.S.D.A. Forest Service 1987; Muzika et al. 1999).

During the summer of 2000, 60 permanent plots that had been established throughout the Fernow Experimental Forest and adjacent areas of the Otter Creek Wilderness during the 1994 field season (Muzika et al. 1999) were sampled, using the same methods described for the present study. All 60 plots were located in areas of relatively undisturbed forest vegetation. Data from those examples (a total of 19) located at moderate (722 to 878 m) elevations on upper slope positions and ridgetops were pooled to produce a set of data comparable to that obtained for the Ozarks in the present study. Because elevations in the central Appalachians as a whole are relatively higher than those in the Ozarks, study sites on the Fernow were located at greater elevations than those sampled in the present study, but both the range of aspects and slope positions were comparable. However, fewer (four) of the study sites in the central Fernow data set were located on ridgetops.

RESULTS AND DISCUSSION

The 20 sites sampled in the Ozarks included seven on ridgetops and 13 located at upper slope positions (Table 1). These sites ranged in elevation from 460 to 692 m and those on slopes

Table 1. Summary data of physical parameters and forest floor cover on 20 study sites sampled in the Ozarks of northwestern Arkansas. Study sites are arranged in order of increasing elevation. RT = ridgetop; US = upper slope.

Site Parameter	Study Site																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Elevation (m)	460	475	488	494	503	506	506	509	527	546	546	591	597	604	613	640	643	689	692	692	566
Slope position	RT	RT	US	US	RT	US	US	US	RT	US	US	US	RT	US	US	US	RT	US	US	RT	–
Woody debris (%)	9	4	2	2	1	2	3	5	3	3	3	1	< 1	5	4	10	< 1	< 1	< 1	< 1	3
Herb cover (%)	5	16	17	11	8	61	2	10	19	20	20	48	11	6	28	32	16	6	7	7	18
Rocks (%)	17	< 1	15	9	4	2	11	10	8	8	5	4	< 1	21	8	14	8	2	< 1	< 1	7
Bryophytes (%)	10	9	18	13	4	15	11	8	10	11	11	10	12	10	17	10	9	6	10	15	11

encompassed all major aspects (N, S, E, and W). Based on data obtained from increment growth cores, the average age of the larger trees at each study site, and thus the time since major disturbance, ranged from 62 to 137 years, with a mean value of 92 for all trees. These ages are consistent with the probable period (1910 to 1920) of widespread logging in the region (Guyette and Spetich 2003). The oldest tree cored had 263 rings; two other trees had ring counts that exceeded 200. The average age of trees in the 19 sites sampled on the Fernow was slightly lower (83 years), and just two trees had ring counts that exceeded 100. The oldest tree had only 132 rings. This suggests that logging on the Fernow, while carried out only about a decade later than in northwestern Arkansas, left fewer trees as potential survivors to the present day.

Twenty-five species were recorded as trees (stems ≥ 10 cm DBH) in the 20 study sites in the Ozarks (Tables 2, 3). Density of stems (n/ha) ranged from 320 to 730, with a mean value of 510. Basal area (m^2/ha) ranged from 18.55 to 38.14, with a mean value of 26.67. Interestingly, the total number of tree species recorded for the Fernow (25) was the same as for the Ozarks, and the two regions had 15 species in common. Density of the tree stratum (n/ha) was lower on the Fernow, where values ranged from 270 to 640 (mean = 412). Conversely, basal area (mean value of 36.23 m^2/ha) was appreciably higher for the Fernow than in the Ozarks. Presumably, this is a result of the more mesic conditions characteristic of the former region.

Based on pooled data for all 20 sites, *Quercus alba*, with a mean importance value (IV) of 33.2, was the leading dominant in the tree stratum for the Ozarks. *Quercus rubra* and *Q. stellata* (post oak) were the only other species with a mean IV > 10. Only three other species, *Acer saccharum, Carya glabra* (pignut hickory), and *C. tomentosa* (mockernut hictory), had a mean IV > 5. However, when study sites located at elevations > 590 m (sites 12–20) were compared with those at < 549 m (sites 1–11), major differences in relative importance were apparent for some of these species. For example, *Q. alba* had an average IV of 50.9 at lower elevations and only 14.7 at higher elevations, whereas the corresponding values for *A. saccharum* were 0.1 and 15.0; *Q. stellata* was not recorded from study sites at higher elevations (Table 2).

Although species richness of the tree stratum was the same for both the Ozarks and the Fernow, leading dominants were not necessarily the same (Table 3). Indeed, two species (*Quercus prinus*

Table 2. Composition of the large tree stratum (stems ≥10 cm DBH) for 20 study sites sampled in the Ozarks of northwestern Arkansas. Study sites are arranged in order of increasing elevation. Importance values are based on 100.

	Importance Values at Study Sites 1–20																				
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Quercus alba	39.5	62.6	7.1	37.3	31.7	33.1	70.4	90.4	45.8	62.9	79.5	1.6	38.9	18.8	–	18.2	18.7	–	10.4	26.1	33.2
Quercus rubra	13.4	3.3	51.1	–	–	7.9	4.3	2.7	10.2	3.5	2.3	5.4	–	22.8	–	9.9	4.9	4.0	52.3	25.2	11.2
Quercus stellata	30.6	2.4	26.0	39.9	52.1	14.8	9.0	2.8	34.1	4.5	–	–	–	–	–	–	–	–	–	–	10.8
Acer saccharum	–	1.6	–	–	–	–	–	–	–	–	–	–	42.0	6.7	58.8	–	26.6	–	–	1.2	6.8
Carya glabra	–	–	–	–	–	–	–	–	–	–	–	22.1	–	3.1	–	26.8	34.1	5.6	15.2	12.6	6.0
Carya tomentosa	–	11.7	–	5.2	4.5	1.3	2.1	–	–	5.7	–	–	–	–	–	17.1	7.2	22.2	7.6	26.7	5.6
Quercus velutina	–	–	–	1.5	4.3	21.0	6.9	2.1	9.9	11.0	5.2	–	–	2.5	–	–	–	–	–	5.4	3.5
Nyssa sylvatica	1.9	5.9	–	2.1	–	–	1.9	–	–	–	–	11.8	–	4.8	–	1.3	2.9	28.1	2.5	–	3.2
Prunus serotina	–	–	–	–	–	–	–	–	–	–	4.3	–	–	5.1	–	24.1	2.1	–	5.7	–	2.1
Liquidambar styraciflua	–	–	–	–	–	–	–	–	–	–	–	–	–	6.6	–	–	–	33.6	–	–	2.0
Quercus marilandica	11.0	–	4.5	9.5	1.1	–	–	–	–	7.5	–	–	–	–	–	–	–	1.4	–	–	1.8
Acer rubrum	–	–	–	–	2.1	–	–	–	–	–	2.6	–	–	24.8	–	–	–	1.8	1.6	1.2	1.7
Carya texana	–	–	10.3	–	–	16.2	1.9	–	–	2.4	1.1	–	–	–	–	–	–	–	–	–	1.6
Carya ovata	–	2.3	–	–	–	–	–	–	–	–	–	7.6	12.3	2.4	–	–	–	–	4.7	–	1.5
Carya cordiformis	–	–	–	–	–	–	–	–	–	–	–	23.0	–	–	3.5	–	–	–	–	–	1.3
Tilia americana	–	–	–	–	–	–	–	–	–	–	–	–	1.8	–	21.0	–	–	–	–	1.6	1.2
Magnolia acuminata	–	–	–	–	–	–	–	–	–	–	–	16.2	–	–	7.4	–	–	–	–	–	1.2
Amelanchier arborea	1.8	1.9	–	4.6	2.2	–	3.3	0.9	–	1.3	2.7	–	–	–	–	2.7	–	–	–	–	1.1
Fraxinus americana	–	–	1.0	–	–	–	–	–	–	–	–	1.4	1.5	–	6.6	–	3.6	1.4	–	–	0.8
Juglans nigra	–	–	–	–	–	–	–	–	–	–	–	10.8	–	–	–	–	–	–	–	–	0.5
Quercus shumardii	–	7.0	–	–	–	–	–	–	–	–	–	–	3.6	–	–	–	–	–	–	–	0.5

Table 2. Continued.

	Importance Values at Study Sites 1–20																				
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Cornus florida	–	1.6	–	–	–	2.4	–	–	–	1.2	2.3	–	–	–	–	–	–	–	–	–	0.4
Robinia pseudoacacia	–	–	–	–	–	–	–	1.1	–	–	–	–	–	2.4	2.7	–	–	–	–	–	0.3
Juniperus virginiana	–	–	–	–	2.1	3.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3
Ulmus crassifolia	1.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.9	–	–	0.2
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 3. Comparison of the large tree (stems ≥ 10 cm DBH) and small tree (stems < 10 cm but ≥ 2.5 cm DBH) strata for the Ozarks in northwestern Arkansas and the Fernow Experimental Forest in eastern central West Virginia. Importance values are based on 100.

	Importance Value			
	Large Tree Stratum		Small Tree Stratum	
Species	Ozark	Fernow	Ozark	Fernow
Quercus alba	34.6	2.3	9.3	–
Quercus rubra	11.2	18.4	2.2	0.3
Quercus stellata	10.8	–	1.3	–
Acer saccharum	6.8	21.3	5.8	48.8
Carya glabra	6.0	0.6	4.9	0.4
Carya tomentosa	5.6	0.5	6.1	0.1
Quercus velutina	3.5	0.6	0.7	–
Nyssa sylvatica	3.2	0.3	8.3	0.2
Prunus serotina	2.1	8.8	5.7	1.4
Liquidambar styraciflua	2.0	–	1.9	–
Quercus marilandica	1.8	–	2.1	–
Acer rubrum	1.7	14.8	11.0	10.0
Carya texana	1.6	–	3.0	–
Carya ovata	1.5	0.3	–	–
Carya cordiformis	1.3	–	–	–
Tilia americana	1.2	4.7	2.2	0.8
Magnolia acuminata	1.2	0.6	0.4	0.4
Amelanchier arborea	1.1	0.2	8.9	3.6
Fraxinus americana	0.8	2.6	0.4	0.1
Quercus shumardii	0.5	–	–	–
Juglans nigra	0.5	–	–	–
Cornus florida	0.4	–	13.2	0.1
Robinia pseudoacacia	0.3	0.3	–	–
Juniperus virginiana	0.3	–	1.1	–
Ulmus crassifolia	0.2	–	2.0	–
Quercus prinus	–	6.9	–	0.1
Liriodendron tulipifera	–	5.7	–	0.1
Fagus grandifolia	–	3.5	–	14.7
Betula lenta	–	2.6	–	1.8
Magnolia fraseri	–	2.4	–	1.7
Oxydendrum arboreum	–	1.2	–	2.0
Castanea dentata	–	0.6	–	0.2
Sassafras albidum	–	0.5	–	–
Tsuga canadensis	–	0.5	–	0.2
Ostrya virginiana	–	0.3	3.1	1.1
Aesculus glabra	–	–	2.8	–
Cercis canadensis	–	–	0.5	–
Asimina triloba	–	–	0.4	–
Crataegus spp.	–	–	0.3	0.1

Table 3. Continued.

	Importance Value			
	Large Tree Stratum		Small Tree Stratum	
Species	Ozark	Fernow	Ozark	Fernow
Celtis occidentalis	–	–	0.3	–
Acer pensylvanicum	–	–	–	11.8
Ulmus americana	–	–	1.3	–
Hamamelis virginiana	–	–	–	0.2
TOTAL	100	100	100	100

and *Liriodendron tulipifera*) that were relatively important components of the tree stratum on the Fernow (as well as elsewhere in the Appalachians) do not occur in the Ozarks of northwestern Arkansas (Hunter 1989). *Quercus rubra* and *Acer saccharum* were the only species among the five leading dominants in the tree stratum for both regions. Interestingly, based on the sum of importance values for all of the species present, oaks were much more important in the Ozarks (ΣIV = 62.4) than on the Fernow (ΣIV = 28.2), and hickories exhibited the same pattern, with ΣIV of 16.0 and 1.4, respectively. However, as already noted, overall dominance of oaks was lower for those study sites located at the highest elevations sampled in the Ozarks.

Twenty-seven species were recorded as small trees (stems < 10 cm but ≥ 2.5 cm DBH) in the Ozarks (Tables 3, 4). This total included several species [*Aesculus glabra* (buckeye), *Tilia americana, Cercis canadensis* (redbud), and *Asimina triloba* (pawpaw)] not represented in the tree stratum. Density of stems (n/ha) ranged from 30 to 690, with a mean value of 340. Basal area (m^2/ha) ranged from 0.09 to 2.22, with a mean value of 0.96. Based on pooled data from all 20 study sites, *Cornus florida* (dogwood), *Acer rubrum, Quercus alba, Amelanchier arborea* (serviceberry), and *Nyssa sylvatica* were the leading species present. Species richness of the small tree stratum was slightly lower for the Fernow (24 species). Only two species (*A. rubrum* and *A. arborea*) were among the five leading dominants in both regions. *Acer saccharum* (mean IV = 48.8) was clearly dominant in this stratum for the Fernow. Overall, this species was relatively less important (mean IV = 5.8) in the Ozarks, but it was the leading dominant in two study sites located at higher elevations. Oaks were much more dominant as small trees in the Ozarks (ΣIV = 15.6) than in the Fernow (ΣIV = 0.4), whereas the

Table 4. Composition of the small tree (< 10 but ≥ 2.54 cm DBH) stratum for study sites sampled in the Ozarks of northwestern Arkansas. Importance values are based on 100. Study sites are arranged in order of increasing elevation.

Species	Importance Values at Study Sites 1–20																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Cornus florida	3.1	30.4	–	18.5	29.7	51.8	6.6	–	17.6	35.5	76.1	–	–	2.7	–	4.2		1.5	3.9	–	13.2
Acer rubrum	1.4	–	–	3.8	7.5	–	10.4	44.9	–	–	4.4	–	–	63.1	69.0	–	–	1.0	0.9	13.1	11.0
Quercus alba	44.3	–	–	9.5	16.0	4.5	–	42.0	42.5	2.5	–	–	–	4.0	–	6.7	–	6.4	5.0	3.2	9.3
Amelanchier arborea	29.8	5.7	29.3	11.8	–	–	24.8	10.7	26.6	20.0	8.9	–	–	–	–	6.9	–	–	-	3.0	8.9
Nyssa sylvatica	7.1	30.9	–	2.8	–	–	20.6	–	–	–	–	22,1	–	24.3	–	16.0	–	33.6	–	8.8	8.3
Carya tomentosa	4.1	3.0	–	16.1	10.6	–	6.4	–	–	15.4	–	–	–	–	–	6.0	17.9	–	30.0	12.5	6.1
Acer saccharum	–	4.2	–	–	–	1.9	–	–	–	–	-	–	51.2	–	–	11.4	40.8	–	7.5	-	5.8
Prunus serotina	1.4	–	–	6.0	8.5	12.5	3.8	–	7.1	5.0	4.1	–	–	–	–	7.2	13.3	13.9	5.9	24.7	5.7
Carya glabra		5.1	–	–	–	–	–	–	–	–	–	9.3	–	–	–	30.9	28.0	–	11.9	13.0	4.9
Ostrya virginiana	–	20.8	-	–	–	–	–	–	–	–	–	8.0	–	–	–	8.8	–	–	21.7	2.0	3.1
Carya texana	–	–	21.0	–	–	7.3	–	–	–	21.6	6.6	–	–	–	–	–	–	–	–	3.7	3.0
Aesculus glabra	–	–	–	–	–	-	–	–	–	–	–	–	48.8	–	8.0	-	–	–	–	–	2.8
Tilia americana	–	–	–	–	–	–	–	–	–	–	–	15.8	–	–	23.5	–	-	–	3.8	–	2.2
Quercus rubra	1.8	–	9.9	–	4.7	–	17.8	2.4	–	–	–	–	–	–	–	–	–	4.3	2.3	–	2.2
Quercus marilandica	1.4	–	2.7	26.0	5.4	–	2.2	–	–	–	–	–	–	–	–	–	–	3.9	0.9	–	2.1
Ulmus crassifolia	–	–	4.9	2.8	4.3	22.0	2.8	–	–	–	–	–	–	–	–	–	–	2.2	–	–	2.0
Liquidambar styraciflua	–	–	–	–	–	–	–	–	–	-	–	–	–	5.9	–	–	–	30.1	–	2.1	1.9
Ulmus americana	–	–	–	–	–	–	–	–	–	–	-	14.8	–	–	–	–	–	1.1	–	10.3	1.3
Quercus stellata	–	–	25.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.3
Juniperus virginiana	5.7	–	4.4	2.7	5.2	–	4.5	–	–	–	–	–	–	–	–	–	–	–	–	–	1.1
Quercus velutina	–	–	–	–	2.7	–	–	–	6.2	–	–	–	–	–	–	–	–	2.2	2.0	–	0.7

Table 4. Continued.

Species	Importance Values at Study Sites 1–20																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Cercis canadensis	–	–	–	–	–	–	–	–	–	–	–	7.2	–	–	–	–	–	–	3.3	–	0.5
Asimina triloba	–	–	–	–	–	–	–	–	–	–	–	9.9	–	–	–	–	–	–	–	–	0.5
Fraxinus americana	–	–	2.1	–	–	–	–	–	–	–	–	–	–	–	–	2.1	–	–	0.9	3.4	0.4
Magnolia acuminata	–	–	–	–	–	–	–	–	–	–	–	7.9	–	–	–	–	–	–	–		0.4
Crataegus spathulata	–	–	–	–	5.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3
Celtis occidentalis	–	–	–	–	–	–	–	–	–	–	–	5.0	–	–	–	–	–	–	–	–	0.3
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

latter region was characterized by higher mean values for both total density (479 stems/ha) and total basal area (1.22 m^2/ha).

Thirty species were recorded as saplings (individuals of tree species < 2.5 cm DBH but ≥ 1.0 m tall) in the Ozarks. Density of stems (n/ha) ranged from 50 to 2890, with a mean value of 600. *Acer rubrum, Quercus rubra, Nyssa sylvatica, Ostrya virginiana* (hop hornbeam), *Q. marilandica* (blackjack oak), *Prunus serotina*, and *Amelanchier arborea* were the most important species. Except for *Q. rubra*, all of these were either absent or much less abundant in the tree stratum. On the Fernow, *Acer pensylvanicum* (striped maple), and *A. saccharum* were the overwhelming dominants. Together, these two species represented 82.7% of all stems recorded as saplings. *Acer rubrum, A. arborea*, and *P. serotina* were present but relatively less important than in the Ozarks. Density (n/ha) of the sapling stratum was lower in the Ozarks (600) than in the Fernow, where the mean value was 990, with a range from 10 to 2490. This higher value may reflect a larger proportion of relatively more shade tolerant tree species. However, the total number of species recorded as saplings on the Fernow (21) was appreciably lower than in the Ozarks (30).

Thirty-eight species were recorded as large seedlings (individuals of tree species ≥ 10 cm but < 1.0 m tall) in the Ozarks. Density (n/ha) in this stratum ranged from 4600 to 37,900, with a mean value of 13,200. *Quercus rubra* was the single most important species, representing 26% of all stems. *Ulmus americana* (American elm), the second-ranking species, was not recorded in the tree stratum and was a relatively unimportant component of the small tree stratum. On the Fernow, density of large seedlings ranged from 100 to 36,900 stems/ha, with a mean value of 10,300. The latter is somewhat lower than the value recorded for the Ozarks. *Acer pensylvanicum* (21% of all stems), *A. saccharum* (14%), and *Q. prinus* (13%) were the three most important species, but both *Prunus serotina* and *Q. rubra* were relatively common and each represented > 10% of all stems. The total number of species recorded as large seedlings on the Fernow (28) was lower than in the Ozarks.

Twenty species were represented in the small seedling stratum (individuals of tree species < 10 cm tall) for the Ozarks. Density (n/ha) ranged from 4000 to 106,000, with a mean of 19,000. *Acer rubrum* was the single most important species (35% of all stems) but was recorded from this stratum in only half of all study sites. Other

species making up > 10% of all stems were *Quercus rubra, Q. alba, Amelanchier arborea*, and *Prunus serotina*. On the Fernow, density (n/ha) of small seedlings ranged from 15,000 to 281,000, with a mean of 91,000. These values suggest that small seedling density is much higher on the Fernow than in the Ozarks, but the difference is due largely to a very high number of seedlings of *Acer rubrum*. This species alone represented > 70% of all seedlings recorded on the Fernow. The other more important species were *P. serotina, A. saccharum, Q. prinus*, and *A. pensylvanicum*. The number of species recorded in this stratum for the Fernow (19) was essentially the same as for the Ozarks.

As a general observation, oaks were better represented in the sapling, large seedling, and small seedling strata in the Ozarks than on the Fernow, whereas just the reverse was true for maples. *Quercus rubra* was the first or second leading dominant in each stratum for the Ozarks, and maples (*Acer rubrum, A. pensylvanicum*, or *A. saccharum*) had the same relative position on the Fernow. For the most part, the canopy of the forests we sampled in the Ozarks seemed less dense than was the case for forests on the Fernow. It is possible that the increased shading of the forest floor accounts for both the lower number of small seedlings and the lower importance level of oaks noted for the latter region. In the absence of large-scale disturbance, it seems likely that the Ozark forests will continue to be characterized by a higher level of oak dominance than forests on the Fernow. Although oaks are conspicuously underrepresented in the small tree, sapling, and seedling strata in both regions, this is more apparent on the Fernow than in the Ozarks.

Twenty species were recorded as shrubs in the Ozarks (Table 5). Density (n/ha) ranged from 2000 to 132,300, with a mean of 38,700. In general, the highest values were recorded at elevations > 590 m (study sites 12–20). *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (poison ivy) were the overwhelming dominants and represented 87% of all stems recorded for the shrub stratum. Only three other taxa contributed > 3% of the total number of stems. These were *Rubus* spp. (blackberry), *Vitis rotundifolia* (grape), and *Vaccinium pallidum* (blueberry). Only 16 species were recorded as shrubs on the Fernow, where shrub density (n/ha) ranged from 0 to 26,400 (mean = 5300), which was appreciably lower than in the Ozarks. However, the high values recorded for the latter region can be attributed, at least in part, to

Table 5. Composition of the shrub stratum for study sites sampled in the Ozarks of northwestern Arkansas. Study sites are arranged in order of increasing elevation. Data are numbers of stems per 0.01 ha. P = present in the study site but not recorded from the subplots used to sample this stratum.

	Shrub Stem Density (n/0.01 ha) on Study Sites 1–20																				
Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Parthenocissus quinquefolia	1	217	16	52	7	84	31	2	P	16	28	517	723	24	403	619	268	520	975	1025	5528
Toxicodendron radicans	–	156	2	5	5	1	6	1	–	2	1	21	40	6	21	268	2	321	76	275	1209
Rubus spp.	1	2	–	20	10	10	4	25	9	3	P	P	–	–	–	24	85	6	94	1	294
Vitis rotundifolia	–	–	P	52	168	20	–	–	–	4	–	11	1	1	P	7	–	1	–	–	265
Vaccinium pallidum	123	–	–	–	–	–	–	11	81	P	–	–	–	P	–	–	–	20	–	–	235
Smilax glauca	11	P	1	1	1	11	21	4	P	–	6	–	–	13	–	8	–	14	P	–	91
Lonicera japonica	–	–	–	–	–	–	–	–	–	–	–	P	23	–	–	P	–	–	–	–	23
Vitis riparia	–	–	–	–	–	P	–	2	–	–	–	P	–	–	–	–	–	1	P	18	21
Frangula caroliniana	–	–	P	1	–	3	–	–	–	–	–	–	–	–	5	9	P	–	–	–	18
Vaccinium stamineum	–	–	–	7	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	12
Smilax rotundifolia	–	–	–	–	2	–	2	–	–	2	3	P	–	–	2	P	–	–	–	–	11
Smilax bona-nox	–	–	1	–	–	–	2	P	P	P	1	–	2	–	–	–	P	4	P	–	10
Viburnum rufidulum	1	1	–	–	–	3	–	–	P	P	P	–	–	–	–	–	P	–	–	–	5
Clematis catesbyana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	4
Menispermum canadense	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	1	–	3
Cladrastis kentukea	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2
Rosa cf. *carolina*	–	–	–	–	–	2	–	–	–	–	–	P	–	–	–	–	–	–	–	–	2
Vaccinium arboreum	–	P	–	P	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Hamamelis virginiana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	–	–	–	–	P
Mimosa sp.	–	–	–	–	–	–	–	–	P	–	–	–	–	–	–	–	–	–	–	–	P
Sambucus canadensis	–	–	–	–	–	–	–	–	–	–	–	P	–	–	P	–	–	–	–	–	P
TOTAL	137	376	20	138	195	134	66	45	90	32	39	550	791	44	431	935	356	887	1146	1323	7735

the exceedingly numerous stems (> 500 per 0.01 ha) of *P. quinquefolia* and *T. radicans* in a few study sites, especially towards higher elevations. *Smilax rotundifolia* (greenbrier) was the dominant shrub (44% of all stems) on the Fernow, with *V. pallidum*, *Rubus* spp., and *Viburnum acerifolium* (mapleleaf viburnum) the only other species representing > 5% of the total number of stems. Only one (*Vaccinium pallidum*) of the more important members of the shrub stratum in the Ozarks is a member of the Ericaceae, and the conspicuous absence of ericads represents an important difference between these study sites and comparable sites on the Fernow and elsewhere throughout the Appalachians, where species of *Vaccinium* and *Rhododendron* are consistently present and often important (Stephenson and Adams, pers. obs.).

At least 125 taxa were present in the herb stratum of the sites sampled in the Ozarks (Table 6). Total herb cover varied widely, ranging from 2% to 61% and with a mean value of 15% (Table 1). Relatively few species were recorded from more than half of the 20 study sites, but *Dichanthelium dichotomum* (panic grass), which was recorded from 13 sites, had the highest mean cover value. Other species with mean cover values > 0.7 were *Amphicarpaea bracteata* (recorded from 14 sites), *Brachyelytrum erectum* (6 sites), *Monarda russeliana* (15 sites), *Bromus pubescens* (7 sites), and *D. linearifolium* (7 sites). As such, four of the six leading dominants in the herb stratum were grasses. The number of species of herbs (ca. 105) recorded for the 19 study sites on the Fernow was somewhat lower than in the Ozarks. Moreover, several important floristic differences in the two assemblages of species were apparent. For example, ferns were essentially absent from the herb stratum of the 20 study sites in the Ozarks, which was very different from the Fernow and also the usual situation throughout the Appalachians (Coxe et al. 2006). Moreover, members of the Liliaceae made up a higher proportion of the species recorded on the Fernow, where overall herb cover ranged from < 1% to 100% (mean = 28%). The latter value is almost twice the corresponding figure recorded for the Ozarks, which suggests that the herb stratum is better developed on the Fernow. Presumably, this would have some ecological consequences and could account, at least in part, for the lower numbers of small seedlings in these forests.

Values recorded for coarse woody debris ranged from < 1 to almost 10% (mean = 2.9%), bryophyte cover from 3.8 to 18% (mean = 10.8%), and exposed rocks from 0 to 21% (mean = 7.3%;

Table 6. Composition of the herbaceous stratum for study sites in the Ozarks of northwestern Arkansas. Study sites are arranged in order of increasing elevation. Numbers reflect percent cover (maximum = 100). P = present in the study site but not recorded from the subplots used to sample this stratum.

	Herbaceous Cover (%) on Study Sites 1–20																				
Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Dichanthelium dichotomum	P	P	3.8	0.3	0.3	15.6	P	2.0	0.3	5.0	6.8	–	–	–	–	–	3.8	–	2.8	–	2.0
Amphicarpaea bracteata	–	–	0.3	–	–	16.5	–	–	P	P	P	6.3	1.5	P	0.3	0.8	1.5	1.8	0.5	0.5	1.5
Brachyelytrum erectum	–	–	7.7	–	–	5.3	P	–	–	–	–	9.0	–	P	–	–	–	–	–	P	1.1
Monarda russeliana	–	2.0	P	3.0	–	5.3	P	–	P	1.8	0.5	P	–	P	P	2.0	0.8	1.5	–	0.8	0.9
Bromus pubescens	–	–	–	–	P	P	–	–	–	–	–	9.8	0.3	–	P	7.3	–	P	–	–	0.8
Dichanthelium linearifolium	1.8	1.5	–	0.3	–	3.0	–	–	5.8	1.8	–	–	–	20	–	–	–	–	–	–	0.8
Carex cephalophora	–	P	0.3	4.3	–	–	P	–	1.5	3.0	8.8	–	–	–	–	–	–	–	–	–	0.8
Danthonia spicata	2.0	–	–	0.3	–	–	–	1.8	5.3	4.0	–	–	–	–	–	–	–	–	–	–	0.7
Dioscorea quaternata	–	P	–	–	–	2.0	–	–	–	–	–	1.5	–	–	P	6.8	–	–	–	3.0	0.7
Unidentified *Aster*/*Solidago*	–	P	P	P	P	0.3	P	P	1.5	–	P	1.5	–	–	6.3	0.3	0.5	P	P	1.5	0.6
Helianthus hirsutus	–	0.3	1.5	–	3.8	2.3	–	P	–	–	–	–	–	–	–	4.0	P	–	P	–	0.6
Viola spp.	–	–	–	–	–	1.3	–	–	–	–	–	1.8	4.3	–	1.3	0.5	P	0.5	0.5	0.3	0.5
Solidago ulmifolia	–	P	–	P	P	3.0	–	P	P	–	–	4.3	P	–	P	1.5	0.3	0.3	–	–	0.5
Scutellaria ovata	–	1.5	0.3	1.5	–	0.3	–	–	–	–	–	–	3.0	–	–	–	1.5	–	–	–	0.4
Carex albicans	–	–	–	–	0.5	2.0	–	–	–	–	–	P	–	–	P	–	5.3	–	–	–	0.4
Galium pilosum	–	–	–	0.3	P	0.3	–	–	–	–	–	–	–	2.3	–	2.5	0.5	P	1.5	0.5	0.4
Podophyllum peltatum	–	–	–	–	–	–	–	–	–	–	–	4.5	–	–	1.5	–	–	–	–	–	0.3
Lespedeza sp.	0.3	–	–	–	–	–	–	1.5	2.5	1.5	–	–	–	–	–	–	–	–	–	–	0.3

Table 6. Continued.

	Herbaceous Cover (%) on Study Sites 1–20																				
Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Desmodium canescens	–	2.3	P	–	1.5	15	P	P	–	P	P	–	–	P	–	0.3	–	P	P	–	0.3
Uvularia perfoliata	–	–	–	–	–	–	–	–	–	–	–	P	–	–	5.5	–	–	–	–	–	0.3
Viola canadensis	–	–	–	–	–	–	–	–	–	–	–	2.5	–	–	3.0	–	–	–	–	–	0.3
Dichanthelium boscii	–	0.3	–	P	–	–	–	–	–	5.0	–	–	–	–	–	–	–	–	–	–	0.3
Thalictrum thalictroides	–	1.8	–	–	–	–	–	–	–	–	–	–	1.8	–	0.3	–	1.3	–	–	–	0.3
Carex spp.	–	–	–	–	–	–	–	2.5	–	0.3	0.3	0.3	–	–	–	1.5	–	0.3	–	–	0.3
Galium arkansanum	0.3	2.3	–	P	–	–	–	–	–	–	–	–	–	P	20	–	P	P	–	–	0.2
Unidentified grasses	–	–	1.5	–	–	–	0.3	0.3	0.3	–	–	1.5	–	0.3	–	–	–	–	0.3	–	0.2
Carex oligocarpa	0.3	1.8	–	0.5	–	–	–	–	–	–	–	P	–	–	–	–	–	0.8	–	–	0.2
Viola palmata	–	P	–	–	–	–	–	–	–	–	3.3	–	–	–	–	–	–	–	–	–	0.2
Cynoglossum virginianum	–	P	–	–	–	1.5	–	–	–	P	–	P	P	–	–	1.5	P	–	–	–	0.2
Lespedeza virginica	–	–	0.3	0.5	0.3	–	1.5	–	–	0.3	–	–	–	–	–	–	–	–	–	–	0.1
Aristolochia serpentaria	–	–	0.8	0.3	–	0.5	–	–	–	–	P	0.3	–	–	–	0.3	0.3	P	P	–	0.1
Euphorbia corollata	–	P	0.3	–	P	–	P	–	–	–	–	–	–	–	–	1.5	P	0.5	P	P	0.1
Phlox cf. *pilosa*	–	2.0	–	–	–	–	–	–	–	–	–	–	P	–	–	P	P	–	–	–	0.1
Baptisia bracteata	–	–	–	–	–	–	–	–	1.8	–	–	–	–	–	–	–	–	–	–	–	0.1
Maianthemum racemosum	–	–	–	–	–	–	–	–	–	–	P	–	–	1.5	0.3	P	–	–	–	P	0.1
Osmorhiza longistylis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.8	–	–	–	–	–	0.1
Botrychium virginianum	–	–	–	–	–	–	–	–	–	–	P	1.5	–	P	–	–	–	–	–	–	< 0.1
Carex festucacea	–	–	–	–	1.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 0.1
Cunila origanoides	–	P	–	–	P	–	–	1.5	P	–	–	–	–	P	–	–	–	–	–	–	< 0.1
Eupatorium serotinum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.5	–	–	–	–	–	< 0.1

Table 6. Continued.

Taxon	Herbaceous Cover (%) on Study Sites 1–20																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Hydrastis canadensis	–	–	–	–	–	–	–	–			–	1.5	–	–	–	–	–	–	–	–	< 0.1
Sanguinaria canadensis	–	–	–	–	–	–	–	–	–	–	–	–	P	–	1.5	–	–	–	–	–	< 0.1
Tradescantia cf. *ozarkana*	–	–	–	–	–	–	–	–	–	–	–	–	P	–	1.5	–	–	–	–	–	< 0.1
Trillium cf. *sessile*	–	–	–	–	–	–	–	–	–	–	–	0.3	0.5	–	0.5	–	–	–	–	–	< 0.1
Boehmeria cylindrica	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	0.8	–	–	–	–	–	< 0.1
Scutellaria elliptica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.0	–	< 0.1
Polygonum virginianum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.8	–	–	–	–	–	< 0.1
Circaea lutetiana	–	–	–	–	–	–	–	–	–	–	–	0.5	–	–	P	–	–	–	–	–	< 0.1
Sanicula canadensis	–	0.3	–	–	P	P	–	–	–	–	–	–	–	P	P	0.3	–	–	–	–	< 0.1
Aureolaria grandiflora	–	–	0.3	–	–	–	–	–	P	–	–	–	–	–	–	–	–	–	–	–	< 0.1
Desmodium rotundifolium	–	P	–	–	P	P	–	–	–	0.3	–	–	–	–	–	–	–	–	–	–	< 0.1
Desmodium sp.	–		–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	< 0.1
Hieracium gronovii	–	–	–	–	P	–	P	P	0.3		–	P	–	–	–	P	–	–	–	–	< 0.1
Hypoxis sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	< 0.1
Oxalis cf. *stricta*	–	–	–	–	–	–	–	–	–	–	–	–	P	–	–	0.3	–	–	–	–	< 0.1
Physalis sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	< 0.1
Potentilla simplex	–	–	–	–	P	–	–	–	–	–	–	–	–	–	–	–	P	0.3	–	P	< 0.1
Schizachyrium littorale	P	–	0.3	–	–	–	–	P	–	–	–	–	–	–	–	–	–	–	–	–	< 0.1
Scrophularia marilandica	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	P	–	–	–	–	–	< 0.1
Silene stellata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P	–	0.3	–	–	–	< 0.1
Agrimonia rostellata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	< 0.1
Antennaria parlinii	–	–	P	–	P	–	–	P	P	P	–	–	–	–	–	–	–	0.3	–	–	< 0.1
Vicia sp.	–	–	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	< 0.1

Table 6. Continued.

Taxon	Herbaceous Cover (%) on Study Sites 1–20																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
Other species*	P	–	P	P	–	P	P	–	P	P	P	P	P	P	P	P	P	P	–	P	–
TOTAL	4.5	15.9	16.9	11.3	7.8	60.7	1.8	9.6	19.3	20.3	19.6	47.6	11.3	6.1	27.8	32.0	16.1	5.5	6.6	6.6	–

* *Actaea pachypoda, Ageratina altissima, Andropogon gerardii, Arisaema triphyllum, Asclepias perennis, Asplenium platyneuron, Aster* cf. *cordifolius, A. patens, Baptisia alba, Bidens frondosa, Campanulastrum americanum, Chasmanthium latifolum, Cirsium altissimum, Coreopsis palmata, Desmodium* cf. *pauciflorum, Diarrhena americana, Elymus hystix, E. virginicus, Eragrostis capillaris, Erechtites hieraciifolia, Erigeron strigosus, Euphorbia dentata, Festuca subverticillata, Geum canadense, Hedyotis longifolia, Heliopsis helianthoides, Heuchera americana, Houstonia longifolia, Hyperium* cf. *hypericoides, Impatiens capensis, Lactuca* cf. *canadensis, Liatris hirsuta, Monotropa hypopithys, Parthenium integrifolium, Passiflora lutea, Perilla frutescens, Phytolacca americana, Polygonatum biflorum, Polygonum scandens, Polymnia canadensis, Polystichum acrostichoides, Porteranthus stipulatus, Prenanthes altissima, Pycnanthemum albescens, Rudbeckia hirta, Ruellia pedunculata, Salvia lyrata, Schizachyrium scorparium, Scleria* cf. *oligantha, Setaria parviflora, Solidago hispida, S. petiolaris, S. radula, Symphyotrichum anomalum, S. patens, S. tubinellum, Tephrosia virginiana, Triodanis lamprosperma, Verbesina alternifolia, V. baldwinii, V. virginica,* and *Woodsia obtusa.*

Table 7. Soil physical and chemical characteristics for study sites sampled is the Ozarks of northwestern Arkansas. Study sites are arranged in order of increasing elevation. TEC = total exchange capacity.

Soil Parameter	Study Site 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Mean
pH	5.0	5.7	5.5	5.1	5.4	5.8	5.0	5.0	4.8	5.6	5.3	6.5	5.7	5.2	6.4	5.9	5.5	5.6	5.5	5.0	5.7
Organic matter (%)	4	4	5	4	5	4	4	7	5	5	5	6	9	5	7	7	6	4	7	4	5
Calcium (ppm)	172	499	460	257	275	782	256	198	156	312	370	1763	1444	256	1712	1001	524	237	686	310	583
Magnesium (ppm)	52	101	110	60	64	128	73	62	47	67	79	173	154	63	179	120	84	55	115	63	92
Potassium (ppm)	62	97	84	56	60	100	56	68	52	60	68	143	90	51	98	76	69	43	64	52	72
Phosphorus (ppm)	16	18	22	15	13	14	13	13	112	16	24	16	43	12	36	22	25	11	20	15	24
Manganese (ppm)	59	159	236	114	93	329	142	86	93	108	134	326	171	55	256	134	131	58	112	62	143
Zinc (ppm)	2	2	3	2	2	2	2	2	2	2	2	4	3	2	2	3	2	2	2	2	2
Sodium (ppm)	12	13	11	12	26	11	15	13	11	15	11	12	12	12	12	12	11	11	10	12	13
Sulfur (ppm)	17	17	19	16	17	17	18	18	19	15	16	19	21	17	21	18	19	17	19	18	18
TEC	4.4	4.1	5.2	2.4	2.6	5.3	2.6	5.9	7.9	2.8	4.4	10.7	10.5	6.1	10.4	6.7	5.2	4.5	7.5	5.2	5.7

Table 1). As a general observation, soils were moderately acidic and were characterized by low levels of organic matter but relatively high levels of most macronutrients (Table 7). A comparison of soils data available for the Fernow (Stephenson, unpubl. data) with data obtained in the present study indicates that the soils associated with upland sites in the Ozarks are relatively less acidic (pH 5.7 versus 4.6) than those of comparable sites on the Fernow, whereas levels of calcium (583 versus 318 ppm), magnesium (92 versus 34 ppm), phosphorus (24 versus 5 ppm), and potassium (72 versus 58 ppm) are higher.

In summary, forest communities on topographically similar sites in the Ozarks and on the Fernow Experimental Forest in the central Appalachians area share some species in common, but these species usually display major differences in importance in the two regions. Oaks are generally more important in the Ozarks, but their level of dominance often decreases with increasing elevation while species such as *Acer saccharum*, a major component of ridgetop and upper slope forests on the Fernow, become more important. In both regions, oaks are conspicuously underrepresented in the small tree, sapling and seedling strata, but this is more apparent on the Fernow than in the Ozarks. In the absence of large-scale disturbance, it seems likely that the Ozark forests will continue to be characterized by a higher level of oak dominance than forests on the Fernow.

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