

**A Vascular Plant Inventory of Savanna Communities in the Lower Buffalo Wilderness,
Buffalo National River**

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Table of Contents

List of Figures	iii
List of Tables	iii
List of Appendices	iii
Summary	iv
Acknowledgments.....	v
Introduction.....	1
Study area.....	2
Materials and Methods.....	3
Results.....	4
Discussion	6
Conclusion	8
Literature Cited	9

List of Figures

Figure 1. Location of Buffalo National River.....	11
Figure 2. Location of the project areas and savanna sites (northern sites) in the Lower Buffalo Wilderness.....	12
Figure 3. Location of the project areas and savanna sites (southern sites) in the Lower Buffalo Wilderness.....	13
Figure 4. Zigzag walk-through and sampling within 8 10m ² plots.....	14

List of Tables

Table 1. List of species of concern at Buffalo National River.....	15
Table 2. Average number of vascular plants by form at the study sites.	16
Table 3. List of dominant species and frequency by strata (excluding the herbaceous layer).	16

List of Appendices

Appendix 1. Potential savanna sites surveyed in the Lower Buffalo Wilderness area.....	17
Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas.....	18

Summary

A survey of vascular plants was conducted in savanna habitats at Buffalo National River in 2002. Prior to fieldwork, several potential savanna sites were located using a combination of black and white, color, infrared color aerial photography, and topographic maps. Aerial photos of Turkey Mountain Savanna, a known savanna community of the Lower Wilderness, were used as type photos for comparison. Twenty-four areas were selected for initial field examination and assessed during 2001. A grid of four-hectare plots was randomly overlain on a digital map of potential savanna sites within the Lower Buffalo Wilderness and twenty were randomly selected and inventoried for the presence of vascular plants via random walk three times during the 2002 field season. Nine areas were documented as savanna and include the large and previously identified Turkey Mountain Savanna, an even larger area on the south slope of Granite Mountain and Prince Fred Knob, and several smaller areas of around 5 ha (12.5 acres). Two glades were discovered which had not been located in a previous glade survey. Two hundred fifty-seven species of vascular plants were documented from sixty-eight families. Species per plot averaged 69 with a maximum of 101 and a minimum of 43. Due to past histories of overgrazing and fire suppression, the potential savanna sites located in the Lower Buffalo Wilderness are not typical savanna. Grazing has often reduced the dominance of the grasses and changed the herbaceous species assemblages. Fire suppression has resulted in a growth of younger, smaller trees between the larger, older, open grown savanna trees. It is reasonable to assume that some sites that were formerly savanna communities have been so changed by anthropomorphic and succession as to have changed into other community types such as old field communities or forests. Such sites are not typically identifiable as former savannas and are generally not restorable in the short or medium time frame. It is estimated that all savanna areas within the Lower Buffalo Wilderness have been located and that species lists are well developed. I recommend no further qualitative analysis of the savannas and species, however quantitative community analysis would probably enhance the understanding of savanna communities.

Acknowledgments

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Introduction

In 1998 Congress passed the National Parks Omnibus Management Act in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I&M) program, has undertaken inventories of vascular plants and vertebrates within fifteen parks in eight Midwestern states.

Stemming from this challenge and a widespread concern regarding the status of savannas and their resident vascular plant species at Buffalo National River, an inventory was deemed necessary to determine savanna status and species presence.

A diverse array of wildlife has been documented at Buffalo National River (birds, DeChant and Smith 1996; Kellner 2003; bats, Harvey 1985; herpetofauna, Trauth 1993; plants, Jenkins et al 1997; Logan 1992, 1999) and many rare and unique animal and plant species have been documented (Table 1). Sensitive species include the federally endangered gray bat (*Mysotis grisescens*), Indiana bat (*Myotis sodalis*), and Ozark big-eared bats (*Plecotus rafinesqii*). Forty-two populations of rare plants are associated with seeps and springs and the park contains the Ozark's only elk herd consisting of approximately 400 animals.

Savannas, also called barrens in community ecology literature, are areas of open grown trees with an herbaceous understory of grass and forb species commonly found on prairies. Although there are other differences in savanna communities, they may be thought of as prairies with a thin stand of widely spaced trees or as forests with very few trees and plenty of warm season grasses between them.

External threats from changing land use and development are major concerns for park resource protection. Additional issues include: impounding of river tributaries outside of park; the small portion (11%) of the Buffalo River watershed within National Park Service administrative authority; increasing poultry and livestock operations with minimal state regulation adjacent to the park and throughout the watershed; karst geohydrology of the area expediting rapid transport of pollutants via underground water systems; and finally, little information exists on groundwater recharge to the National River.

The inventory described in this report describes the distribution of savannas and their composition of vascular plants at Buffalo National River. This inventory is a first step in understanding the status of savannas at the park as it 1) identifies some areas that should be monitored closely, and 2) establishes baseline data for the presence of vascular plants within savannas.

Study area

Buffalo National River is located in the rugged Ozark Highlands of northern Arkansas (Figure 1). The project area was located in the Lower Buffalo Wilderness (17,000 acres) located in Marion County, Arkansas (Figure 2). The region is characterized by narrow valleys separated by steep winding ridges and broad mountaintops.

The National River encompasses 149 narrow, linear square miles (95,730 acres) and includes 135 miles of the 150-mile-long Buffalo River from the Boston Mountains to the White River. The headwaters are within the Ozark National Forest and were recently designated as part of the National Wild and Scenic Rivers System. Overall, 11% of the 1338 square mile watershed lies within National Park Service (NPS) administration and 29% is in other federal or state ownership. The majority of the watershed is in private ownership. One-third of the national river's acreage is a part of the National Wilderness Preservation System.

The river has a variety of vegetation types underlain with a karst geology of sink holes, springs, seeps, and approximately 300 known caves including the longest cave system in the state. The vegetation consists of oak, hickory, and beech forests, cedar and sandstone glades, rare river cane communities, and relic plant communities such as post oak savanna remnants.

Materials and Methods

Prior to the inventory, a combination of black and white, color, and infrared color aerial photography and current topographic maps were examined to identify potential savanna sites. Aerial photos of Turkey Mountain Savanna, a known savanna community of the Lower Wilderness, were used as type photos for comparison. As such, areas showing a similar visual signature were chosen for initial field examination (this visual signature tended to show areas where oak growth was sparse, often interspersed with eastern red cedar (*Juniperus virginiana*), and with light colors between). General consideration of the photos, combined with slope, aspect, and elevation considerations, allowed similar areas to be delineated for field examination. Very few areas within the Lower Wilderness had the openness of Turkey Mountain Savanna so areas with less than ideal signatures were included in the list of sites to examine. Twenty-four areas totaling approximately 1200 ha (3000 acres) were selected for initial field examination. During the 2001 field season, all potential savannas identified above were visited to determine which were savannas using a combination of structural and vegetation information observed at that time.

Once potential savanna sites were identified, four-hectare plots (200 x 200 m; 10 ac) were randomly overlain on a digital map of potential savanna sites within the Lower Buffalo Wilderness. Twenty of these plots were randomly selected and inventoried via random walk (Figure 3) three times during the 2002 field season: May, June/July, and September. Eight temporary focal points were randomly selected within each plot, two per plot quarter, and circular 10m² sub-plots were searched for small, inconspicuous plants. Some of the savanna areas were too small to contain a square 4 ha plot and in these cases, the shape of the plot was changed to include all of the savanna area and maximize survey area.

In the course of walking between selected grid cells, species not otherwise previously encountered in the survey were documented. Unique habitats encountered (limited to 30% field time) while surveying were also intensively inventoried.

A complete species list for each plot and for areas of unique habitat, as well as habitat attributes, was recorded using standard field forms. Habitat attributes included physical site characteristics, vegetation description, and canopy strata description.

Voucher specimens were collected for all vascular plant species encountered during the inventory. Legal location information (TRS) was collected for each. Label information included family, genus and trivial names, authority, collection date, collection number, ITIS number, person collecting, person identifying, and location information including county, site name, TRS, and quad map. Roots were included, where possible, with care taken to leave the remaining plants undisturbed. Flowers or seeds, often being necessary for identification, were collected as needed. Vouchers were stored at Buffalo National River offices in Harrison, AR.

Results

Two hundred fifty-seven species of vascular plants were documented from sixty-eight families (Appendix 2) whereas 205 were documented in plots. The majority of plants were in the Asteraceae (37 species), Fabaceae (35 species), and Poaceae (24 species). No rare species were found but the special concern Ozark chinquapin (*Castanea pumila ozarkensis*) was found.

Species per plot averaged 69 with a maximum of 101 and a minimum of 43. Six of the 10 most common plants (>20 occurrences) tended to be woody in habit and included post oak (*Quercus stellata*), winged elm (*Ulmus alata*), grape (*Vitis aestivalis*), Eastern red cedar (*Juniperus virginiana*), blackjack oak, (*Quercus marilandica*), and mockernut hickory (*Carya tomentosa*). Four common herbs include hairy sunflower (*Helianthus hirsutus*), slim leaf panic grass (*Panicum linearifolium*), slender lespedeza (*Lespedeza virginica*), and little bluestem (*Schizachyrium scoparium*).

Nine of the 24 (38%) selected potential savanna areas were documented as being an actual savanna. This includes the large and previously identified Turkey Mountain Savanna, an even larger area on the south slope of Granite Mountain and Prince Fred Knob, and several smaller areas of around 5 ha (12.5 acres)(Figures 3 and 4). Other locations examined and found not to be savannas were commonly found to be oak-hickory forest with closed grown tree (Appendix 1). Two glades were discovered which had not been located in a previous glade survey. One pine forest was located.

Post oak was the most common dominant canopy species in the savannas (Table 2). Other species include short leaf pine (*Pinus echinata*), oaks (*Q. alba*, *marilandica*, *prinoides*, *rubra*, *velutina*) and hickory (*C. texana*, *tomentosa*). Of these, 40% ranged 10-20 m tall, 53% 20-30 m, and the remaining trees > 30 meters in height. Canopy cover ranged 10-60%.

Dominant subcanopy species were similar to those seen in the canopy (Table 2) and included Carolina buckthorn (*Rhamnus caroliniana*), winged elm, and high bush blueberry (*Vaccinium arboretum*). Dominant shrubs included several seen in the canopy and subcanopy (oak and hickory) and also included fragrant sumac (*Rhus aromatica*), Mexican plum (*Prunus mexicana*), winged sumac (*Rhus copallinum*), locust (*Robinia pseudoacacia*), catbriar (*Smilax bonanox*), and deerberry (*Vaccinium stamineum*). Dominant herbs were little bluestem, littlehead nutrush (*Scleria oligantha*), poison ivy (*Toxicodendron radicans*), lespedezas (*Lespedeza hirta*, *violacea*), wingstem (*Verbesina* sp.), and slim leaf panic grass.

The glades lacked canopy and subcanopy and were comprised of a shrub layer dominated by post oak, white ash (*Fraxinus americana*), and gum bumelia (*Bumelia lanuginosa*). Eastern red cedar and fragrant sumac were also present but typically covered less area. Dominant herbs include thel. Trif., little bluestem, and limestone calamint (*Satureja arkansana*) typically covering more area.

The pine forest contained a shrub layer dominated by post oak, Northern red oak (*Quercus rubra*), mockernut hickory (*Carya tomentosa*), and high bush blueberry. There was a lack of any dominant subcanopy and herbaceous layer species but the stand contained 45 plant species.

The study sites identified as potential savanna had a similar average number of forbs as glades yet had almost three times the woody species (Table 3). Overall, study sites had slightly higher numbers of graminoids and slightly lower numbers of ferns than the overall average.

Two hundred fifty-seven voucher specimens were collected and stored at the Buffalo National River offices.

Discussion

In general, all twenty of the 4 ha plots had similar species composition, indicating a singular community type. Study sites had more woody species than glades and about the same average number as the pine area indicating succession towards a more closed community.

The only unique habitats encountered during the survey were a glade on Granite Mountain, a glade below plot 18 (South glade), and a pine-dominated area on a knob near the base of Turkey Mountain. The number of species (45) in the pine area was less than in any of the hardwood areas. Surprisingly, the small ephemeral drainages in the savannas did not possess unique plant assemblages. Probably this is because these areas are not often moist. Rainfall tends to run into the lower streams very quickly.

Due to past histories of overgrazing and fire suppression, the savannas of the Lower Buffalo Wilderness are not typically in good condition. Grazing has often reduced the dominance of the grasses and changed the species mixtures of the forbs in the understories. Fire suppression has resulted in a growth of younger, smaller trees between the larger, older, open grown savanna trees often with the canopy species being found in the subcanopy and shrub layers (see Tables 2 and 3).

It is reasonable to assume that some sites that were formerly savanna communities have been so changed by anthropomorphic and succession factors as to now be other community types such as old field communities or forests. Such sites are not typically identifiable as former savannas and are generally not restorable to savanna in the short or medium time frame. The survey was therefore limited to degraded savanna sites and not to former savanna sites.

Degraded savannas are still identifiable by their large open grown oaks- usually post oaks and chinquapin oaks (*Q. prinoides*). These trees were the primary identifying characteristic for savannas in the field. Once properly structured trees of the correct species were observed, further care was taken to determine that these were not yard trees of a former house place or trees along a former roadway or fencerow.

Finally, the understory was examined to determine if non-native pasture species such as tall fescue (*Festuca elatior*) or Korean lespedeza (*Lespedeza striata*) were present. If they were found, the site was probably abandoned pasture rather than savanna. Often, species such as native warm season grasses or prairie legumes could be identified. However, in some cases the herbaceous understory would be suppressed by the dense growth of small trees or a dense subcanopy of Eastern red cedar. In such cases the existence of savanna would need to be assumed by looking further afield in the surrounding areas.

The microplots were not useful in producing additional species not seen on the random walk. Time spent reading microplots could have been more effectively used increasing the length of the random walk or doing a few more plots. After some trial and adjustment, the best procedure for plot layout and random walk was found to be one that used the random point as a center locus for the 4 ha plot. This center was then used as a base from which to explore the 4 quadrants of

the plot. Use of circular plots would have made center based walks more efficient as corners would not have needed to be considered.

Problems that developed during the initial survey primarily concerned the GPS unit, which was unable to provide location information beneath the canopy and on the lower slopes. The only places the GPS consistently worked were in very high openings such as bluff tops and glades. The use of the GPS to map community boundaries was impossible. Maps of the savanna communities were produced using spot GPS locations and a “connect-the-dots” approach or by using obvious physical features shown on the topographic maps. Features such as ridgetops, knobs, and streams were the most commonly used.

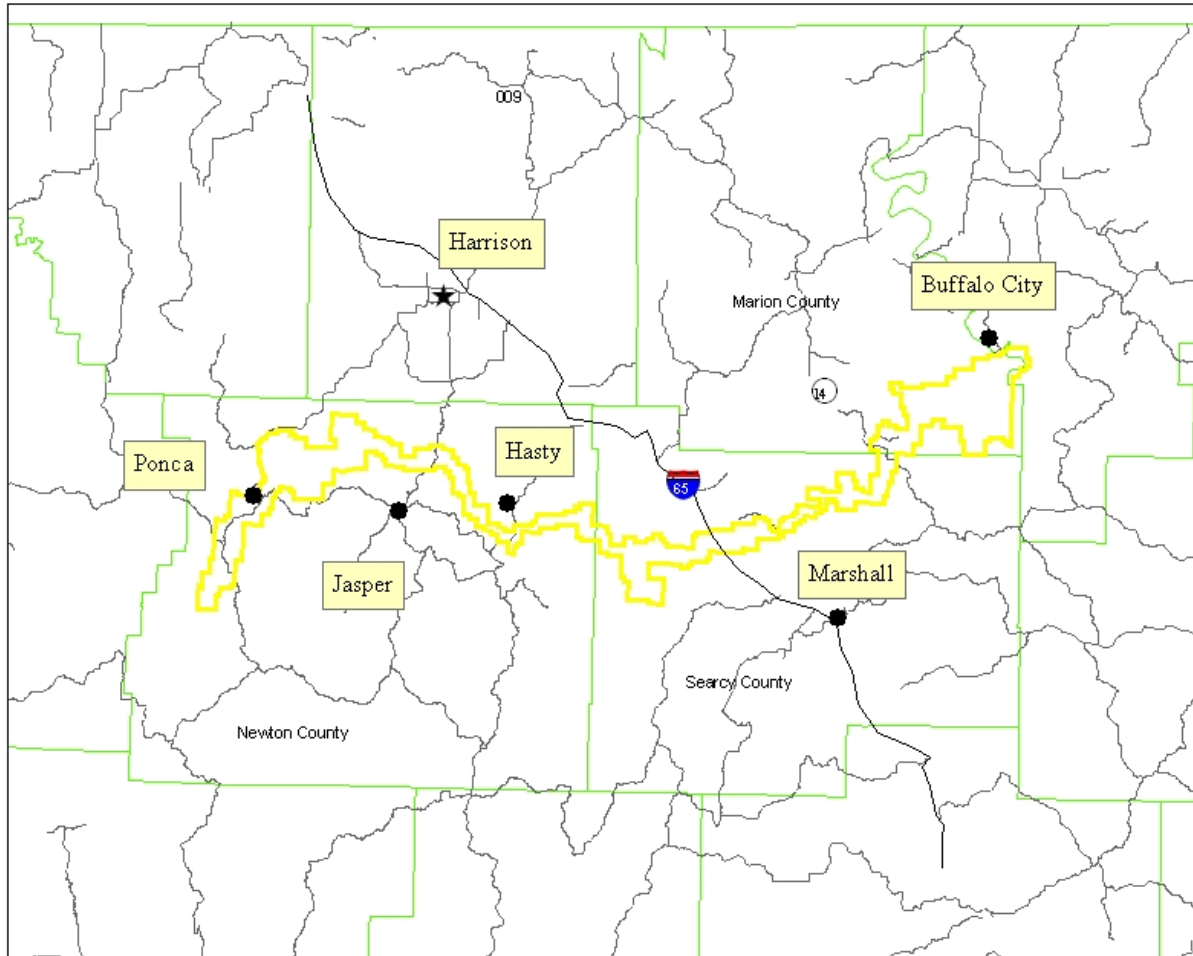
Conclusion

It is estimated that all savanna areas within the Lower Buffalo Wilderness have been located and that species lists are well developed. I recommend no further qualitative analysis of the savannas and species. However, quantitative community analysis would probably enhance the understanding of savanna communities.

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Buffalo National River



0 15 30 60
Kilometers

1:646,722

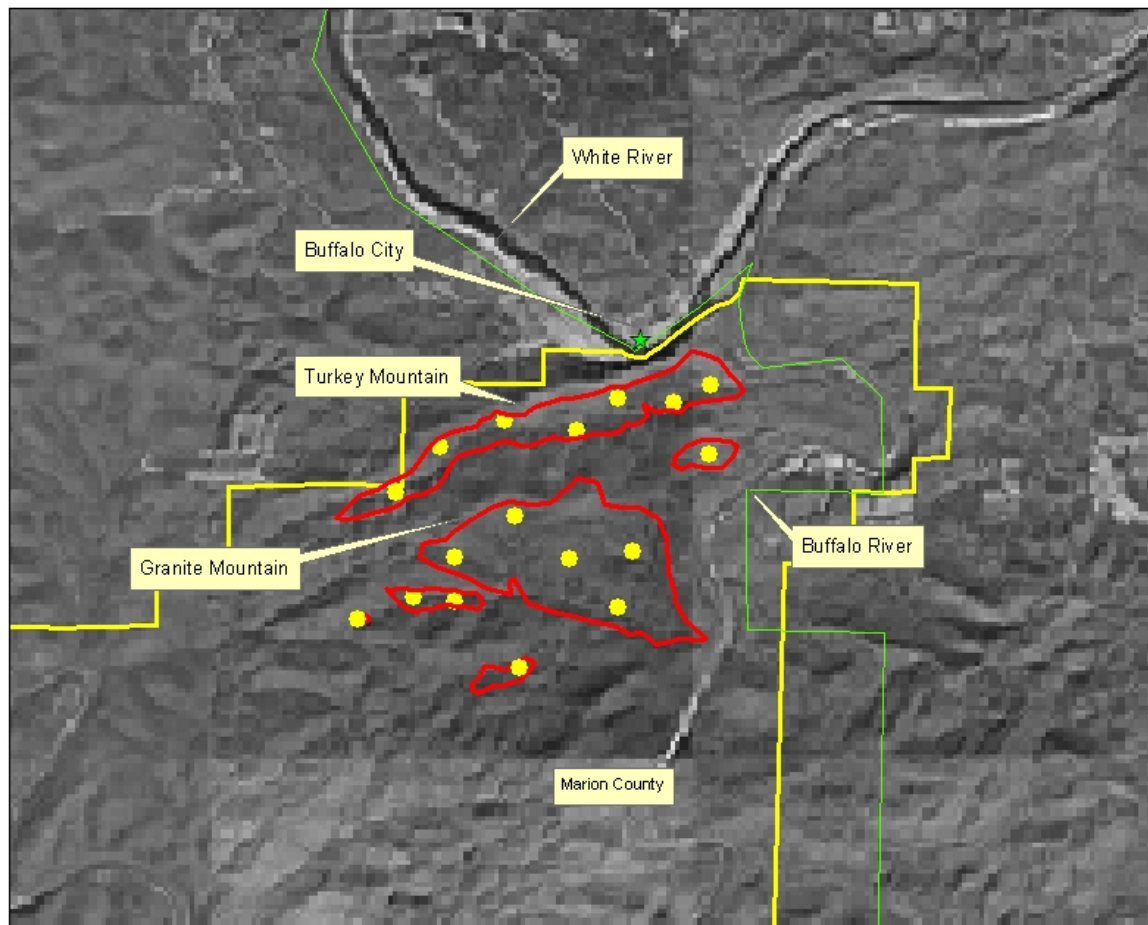


Map Produced by: Heartland Network
Inventory and Monitoring Program

Data Source: National Park Service

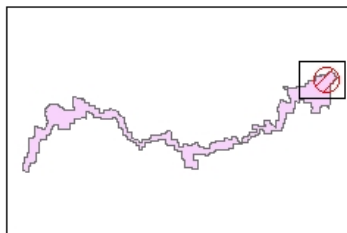
Figure 1. Location of Buffalo National River.

Buffalo National River



0 1.5 3 6
Kilometers

1:64,273

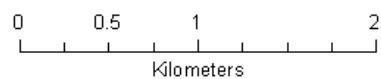
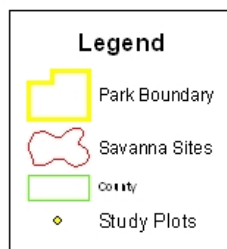
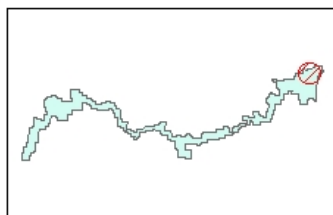
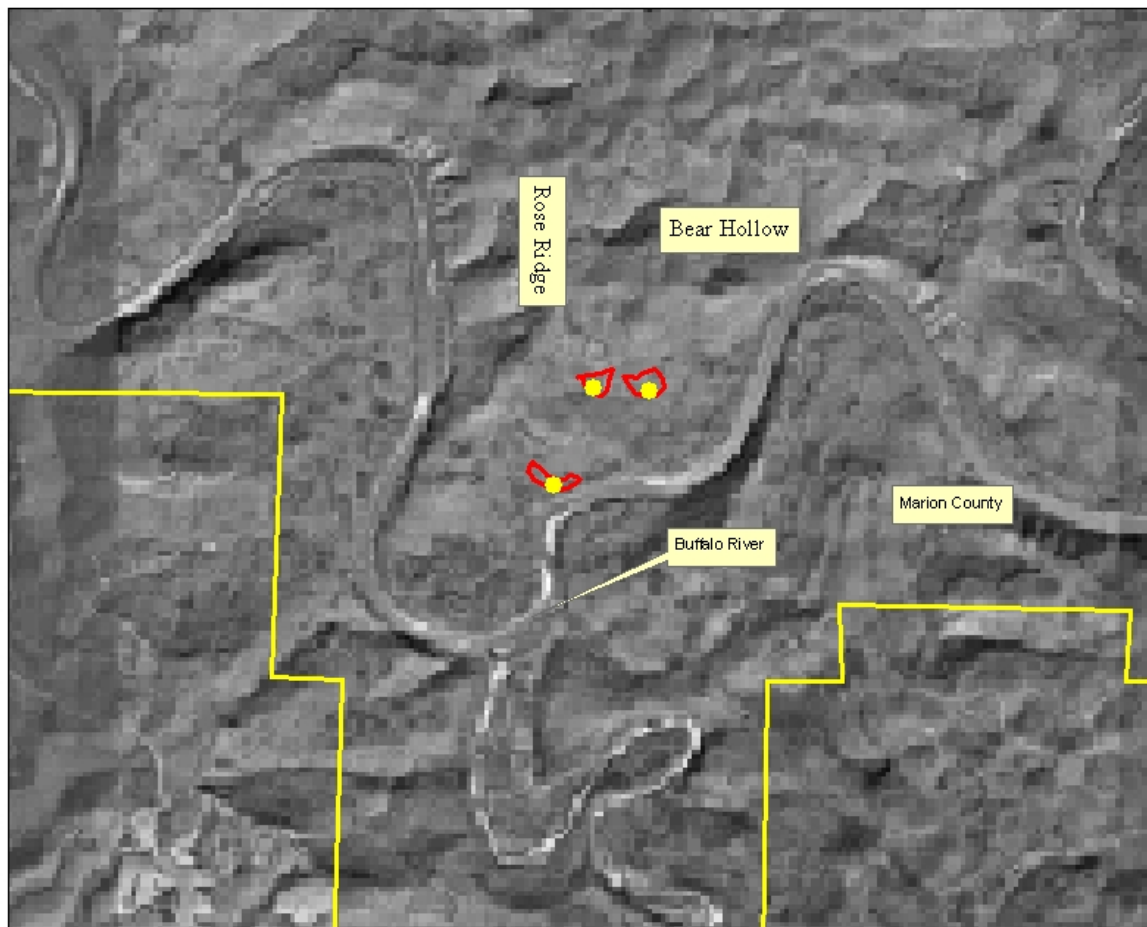


Map Produced by: Heartland Network
Inventory and Monitoring Program

Data Source: National Park Service

Figure 2. Location of the project areas and savanna sites (northern sites) in the Lower Buffalo Wilderness.

Buffalo National River



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Map Produced by: Heartland Network
Inventory and Monitoring Program

Data Source: National Park Service

Figure 3. Location of the project areas and savanna sites (southern sites) in the Lower Buffalo Wilderness.

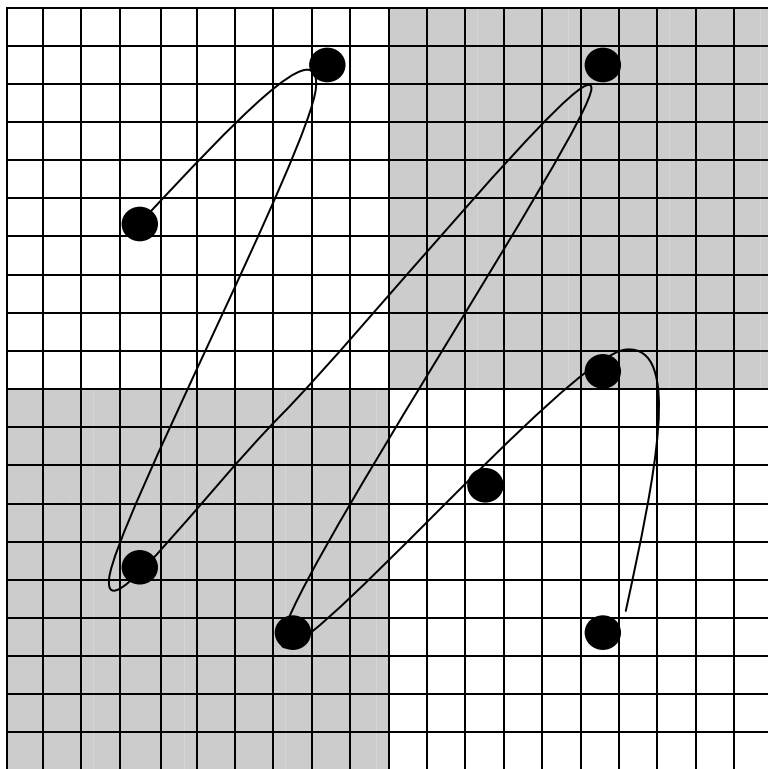


Figure 4. Zigzag walk-through and sampling within 8 10m² plots.

Table 1. List of species of concern at Buffalo National River.

Taxa	Common Name	Scientific Name
Mammal	Elk	<i>Cervus elphus</i>
	Gray bat	<i>Myotis grisescens</i>
	Indiana bat	<i>Myotis sodalis</i>
	Ozark big-eared bat	<i>Plecotus rafinesquii</i>
Bird	Cerulean warbler	<i>Dendroica cerulea</i>
	Swainson's warbler	<i>Limnethlypis swainsonii</i>
Herpetofauna	Eastern collard lizard	<i>Crotaphytus collaris</i>
	Ozark hellbender	<i>Cryptobranchus alleganiensis</i>
	Queen snake	<i>Regina septemvittata</i>
	Western diamondback	<i>Crotalus atrox</i>
Plant	Alabama snowwreath	<i>Neviusia alabamensis</i>
	Arkansas alumroot	<i>Heuchera villosa</i> var. <i>arkansana</i>
	Baldwin's milkvine	<i>Matelea baldwyniana</i>
	Benjamin Franklin bush	<i>Valerianella ozarkana</i>
	Bush's poppymallow	<i>Callirhoe bushii</i>
	Bush's purple coneflower	<i>Echinacea paradoxa</i> var. <i>paradoxa</i>
	Bush's skullcap	<i>Scutellaria bushii</i>
	Butternut	<i>Juglans cinera</i>
	Glade larkspur	<i>Delphinium treleasei</i>
	Largeleaf grass of Parnassus	<i>Parnassia grandiflora</i>
	Littleflower alumroot	<i>Heuchera parviflora</i> var. <i>puberula</i>
	Newton's larkspur	<i>Delphinium newtonianum</i>
	Ozark chinquapin	<i>Castanea pumila</i> var. <i>ozarkensis</i>
	Ozark spiderwort	<i>Tradescantia ozarkana</i>
	Ozark wakerobin	<i>Trillium pusillum</i> var. <i>ozarkanum</i>
	Rosinweed sunflower	<i>Helianthus silphiodes</i>
	Royal catchfly	<i>Silene regia</i>
	Shining indigobush	<i>Amorpha nitens</i>
	Skinner's false foxglove	<i>Agalinis skinneriana</i>
	Southern catalpa	<i>Catalpa bignoniodes</i>
	Tapertin wakerobin	<i>Trillium viridescens</i>

Table 2. Average number of vascular plants by form at the study sites.

Habitat	Forbs	Graminoids	Ferns	Woody
Glades	32	7	2.5	10.5
Pine Area	18	6	0	21
Study Sites	33.95	10.05	1.53	27.05
Overall	33.09	9.65	1.65	25.35

Table 3. List of dominant species and frequency by strata (excluding the herbaceous layer).

	Strata		
Scientific Name	Canopy	Subcanopy	Shrub
Quercus stellata	19	17	3
Pinus echinata	6	1	
Carya texana	3	1	1
Quercus alba	3	1	
Quercus marilandica	2	5	
Quercus rubra	2	6	2
Carya tomentosa	1	7	1
Quercus prinoides	1	2	
Quercus velutina	1		
Juniperus virginiana		3	1
Ulmus alata		2	1
Rhamnus caroliniana		1	1
Vaccinium arboreum		1	4
Prunus mexicana			1
Rhus aromatica			11
Rhus copallina			1
Robinia pseudo-acacia			1
Smilax bona-nox			4
Vaccinium stamineum			2

Appendix 1. Potential savanna sites surveyed in the Lower Buffalo Wilderness area.

Quad	Township	Range	Section	Quarter sections	Savanna?
Big Flat	T17N	R14W	22	N2	No
	T17N	R14W	22	NW1/4SW1/4SW1/4	Yes
	T17N	R14W	21	NE1/4SE1/4SE1/4	Yes
	T17N	R14W	28	SW1/4NE1/4NE1/4	Yes
	T17N	R14W	15	E1/2SE1/4	No
	T17N	R14W	16	SW1/2SE1/4	No
	T17N	R14W	16	N1/4 &	
			17	SE1/4	No
	T17N	R14W	20	NW1/4NE1/4	No
	T17N	R14W	26	W1/4	No
	T18N	R14W	24	NW1/4NW1/4NW1/4	No
	T17N	R14W	13		No
	T18N	R14W	25	S1/2	No
Buffalo City	T18N	R14W	33	SE1/4 &	
			34	S1/2N1/2 &	
			35	N1/2	Yes
	T18N	R14W	35	NW1/4SW1/4SW1/4	Yes
	T17N	R14W	2	W1/2 &	
			3	N1/2 & SE1/4 &	
			4	SE1/4NE1/4	Yes
	T17N	R14W	4	S1/2N1/2SE1/4	Yes
	T17N	R14W	4	NE1/4SW1/4SW1/4	Yes
	T17N	R14W	10	NW1/4NW1/4	Yes
Cozahome	T17N	R14W	18		No
	T17N	R13W	13	NW1/4	No
	T17N	R13W	14	S1/4	No
	T17N	R13W	24	NE1/4NE1/4	No
Rea Valley	T17N	R14W	7	NW1/4NW1/4NE1/4	
				& NE1/4NE1/4NW1/4	No
	T17	R15W	12	SW1/4NE1/4 &	
				SE1/4NW1/4	No

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas.

Scientific Name	Family
<i>Acalypha gracilliens</i>	Euphorbiaceae
<i>Agalinus heterophylla</i>	Scrophulariaceae
<i>Agalinus tenuifolia</i>	Scrophulariaceae
<i>Agave virginica</i>	Amaryllidaceae
<i>Agrimonia rostellata</i>	Rosaceae
<i>Agrostis hyemalis</i>	Poaceae
<i>Allium canadense</i>	Liliaceae
<i>Allium canadense mobilense</i>	Liliaceae
<i>Ambrosia artemisiifolia</i>	Asteraceae
<i>Ambrosia coronopifolia</i>	Asteraceae
<i>Amelanchier arborea</i>	Rosaceae
<i>Amphicarpaea bracteata</i>	Fabaceae
<i>Amsonia illustris</i>	Apocynaceae
<i>Andropogon gerardii</i>	Poaceae
<i>Anemone virginiana</i>	Ranunculaceae
<i>Antennaria plantaginifolia</i>	Asteraceae
<i>Aristida purpurascens</i>	Poaceae
<i>Aristolochia serpentaria</i>	Aristolochiaceae
<i>Asclepias quadrifolia</i>	Asclepiadaceae
<i>Asclepias tuberosa</i>	Asclepiadaceae
<i>Asclepias verticillata</i>	Asclepiadaceae
<i>Asplenium platyneuron</i>	Polypodiaceae
<i>Aster anomalus</i>	Asteraceae
<i>Aster patens</i>	Asteraceae
<i>Astragalus canadensis</i>	Fabaceae
<i>Baptisia bracteata</i>	Fabaceae
<i>Berchemia scandens</i>	Rhamnaceae
<i>Bouteloua curtipendula</i>	Poaceae
<i>Bumelia lanuginosa</i>	Sapotaceae
<i>Callicarpa americana</i>	Verbenaceae
<i>Callirhoe digitata</i>	Malvaceae
<i>Campsis radicans</i>	Bignoniaceae
<i>Carex cephalophora</i>	Cyperaceae
<i>Carex cephalophora mesochorea</i>	Cyperaceae
<i>Carex festucacea</i>	Cyperaceae
<i>Carex granularis</i>	Cyperaceae
<i>Carex grvida</i>	Cyperaceae
<i>Carex tenera</i>	Cyperaceae
<i>Carex vulpinoidea</i>	Cyperaceae

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas (cont.).

Scientific Name	Family
<i>Carya illinoensis</i>	Juglandaceae
<i>Carya texana</i>	Juglandaceae
<i>Carya tomentosa</i>	Juglandaceae
<i>Cassia fasciculata</i>	Fabaceae
<i>Cassia nictitans</i>	Fabaceae
<i>Castanea pumila ozarkensis</i>	Fagaceae
<i>Ceanothus americanus</i>	Rhamnaceae
<i>Celtis occidentalis</i>	Ulmaceae
<i>Celtis tenuifolia</i>	Ulmaceae
<i>Cercis canadensis</i>	Fabaceae
<i>Chasmanthium latifolium</i>	Poaceae
<i>Cheilanthes lanosa</i>	Polypodiaceae
<i>Chionanthus virginicus</i>	Oleaceae
<i>Cirsium altissimum</i>	Asteraceae
<i>Cirsium carolinianum</i>	Asteraceae
<i>Clitoria mariana</i>	Fabaceae
<i>Comandra richardsiana</i>	Santalaceae
<i>Commelina erecta</i>	Commelinaceae
<i>Coreopsis lanceolata</i>	Asteraceae
<i>Coreopsis palmata</i>	Asteraceae
<i>Coreopsis tripteris</i>	Asteraceae
<i>Cornus drummondii</i>	Cornaceae
<i>Cornus florida</i>	Cornaceae
<i>Cortaderia selloana</i>	Poaceae
<i>Cotinus obovatus</i>	Anacardiaceae
<i>Crataegus crus-galli</i>	Rosaceae
<i>Croton capitatus</i>	Euphorbiaceae
<i>Croton elliptica</i>	Euphorbiaceae
<i>Croton monanthogynus</i>	Euphorbiaceae
<i>Cunila origanoides</i>	Lamiaceae
<i>Cyperus plukenetii</i>	Cyperaceae
<i>Cyperus squarrosus</i>	Cyperaceae
<i>Cystopteris fragilis</i>	Polypodiaceae
<i>Cystopteris protrusa</i>	Polypodiaceae
<i>Daleia candida</i>	Fabaceae
<i>Daleia purpurea</i>	Fabaceae
<i>Danthonia spicata</i>	Poaceae
<i>Delphinium carolinianum</i>	Ranunculaceae
<i>Desmanthus illinoensis</i>	Fabaceae

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas (cont.).

Scientific Name	Family
Desmodium canescens	Fabaceae
Desmodium ciliare	Fabaceae
Desmodium cuspidatum	Fabaceae
Desmodium glutinosum	Fabaceae
Desmodium paniculatum	Fabaceae
Desmodium rigidum	Fabaceae
Desmodium rotundifolium	Fabaceae
Desmodium sessilifolium	Fabaceae
Dicanthelium boscii	Poaceae
Dicanthelium dichotomum	Poaceae
Dicanthelium malacophyllum	Poaceae
Dicanthelium oligosanthos	Poaceae
Dicanthelium ravenelii	Poaceae
Diodia teres	Rubiaceae
Dioscorea villosa	Dioscoreaceae
Diospyros virginiana	Ebenaceae
Dodecatheon meadia	Primulaceae
Echinacea pallida	Asteraceae
Echinacea purpurea	Asteraceae
Eleocharis lanceolata	Cyperaceae
Elymus virginicus	Poaceae
Erigeron pulchellum	Asteraceae
Erigeron strigosus	Asteraceae
Eriogonum longifolium	Polygonaceae
Eryngium yuccifolium	Apiaceae
Eupatorium altissimum	Asteraceae
Euphorbia corollata	Euphorbiaceae
Euphorbia cyathophora	Euphorbiaceae
Euphorbia dentata	Euphorbiaceae
Fraxinus americanus	Oleaceae
Galium arkansanum	Rubiaceae
Galium circaezans	Rubiaceae
Galium virgatum	Rubiaceae
Gaura longiflora	Onagraceae
Grindelia lanceolata	Asteraceae
Helianthus hirsutus	Asteraceae
Heuchera americana	Saxifragaceae
Hieracium gronovii	Asteraceae
Houstonia longifolia	Rubiaceae

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas (cont.).

Scientific Name	Family
<i>Hypericum hypericoides</i>	Hypericaceae
<i>Hypericum prolificum</i>	Hypericaceae
<i>Hypericum sphaerocarpum</i>	Hypericaceae
<i>Juglans nigra</i>	Juglandaceae
<i>Juniperus virginiana</i>	Cupressaceae
<i>Kuhnia eupatorioides</i>	Asteraceae
<i>Lechea tenuifolia</i>	Cistaceae
<i>Lespedeza capitata</i>	Fabaceae
<i>Lespedeza cuneata</i>	Fabaceae
<i>Lespedeza hirta</i>	Fabaceae
<i>Lespedeza intermedia</i>	Fabaceae
<i>Lespedeza procumbens</i>	Fabaceae
<i>Lespedeza repens</i>	Fabaceae
<i>Lespedeza stuevei</i>	Fabaceae
<i>Lespedeza violaceae</i>	Fabaceae
<i>Lespedeza virginica</i>	Fabaceae
<i>Liatris aspera</i>	Asteraceae
<i>Liatris pycnostachya</i>	Asteraceae
<i>Liatris squarrosa</i>	Asteraceae
<i>Lithospermum canescens</i>	Boraginaceae
<i>Lobelia spicata</i>	Campanulaceae
<i>Lonicera dioica</i>	Caprifoliaceae
<i>Matelea decipiens</i>	Asclepiadaceae
<i>Melilotus alba</i>	Fabaceae
<i>Melilotus officinalis</i>	Fabaceae
<i>Minuartia patula</i>	Caryophyllaceae
<i>Mirabilis albida</i>	Nyctaginaceae
<i>Monarda fistulosa</i>	Lamiaceae
<i>Morus rubra</i>	Moraceae
<i>Muhlenbergia sobolifera</i>	Poaceae
<i>Nyssa sylvatica</i>	Nyssaceae
<i>Onosmodium subsetosum</i>	Boraginaceae
<i>Ophioglossum engelmannii</i>	Ophioglossaceae
<i>Opuntia humifusa</i>	Cactaceae
<i>Osmorhiza longistylis</i>	Apiaceae
<i>Ostrya virginiana</i>	Betulaceae
<i>Oxalis stricta</i>	Oxalidaceae
<i>Oxalis violaceae</i>	Oxalidaceae
<i>Palafoxia callosa</i>	Asteraceae

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas (cont.).

Scientific Name	Family
<i>Panicum anceps</i>	Poaceae
<i>Panicum clandestinum</i>	Poaceae
<i>Panicum latifolium</i>	Poaceae
<i>Panicum linearifolium</i>	Poaceae
<i>Panicum virgatum</i>	Poaceae
<i>Parthenocissus quinquefolia</i>	Vitaceae
<i>Paspalum leave</i>	Poaceae
<i>Passiflora lutea</i>	Passifloraceae
<i>Pedicularis canadensis</i>	Scrophulariaceae
<i>Pellaea glabella</i>	Polypodiaceae
<i>Penstemon arkansanus</i>	Scrophulariaceae
<i>Penstemon digitalis</i>	Scrophulariaceae
<i>Penstemon tubiflorus</i>	Scrophulariaceae
<i>Phlox pilosa</i>	Polemoniaceae
<i>Phryma leptostachya</i>	Phrymaceae
<i>Physalis virginiana</i>	Solanaceae
<i>Physocarpus opulifolius</i>	Rosaceae
<i>Phytolacca americana</i>	Phytolaccaceae
<i>Pinus echinata</i>	Pinaceae
<i>Plantago</i> sp.	Plantaginaceae
<i>Polygala senega</i>	Polygalaceae
<i>Polytaenia nuttallii</i>	Apiaceae
<i>Porteranthus stipulatus</i>	Rosaceae
<i>Prunella vulgaris</i>	Lamiaceae
<i>Prunus mexicana</i>	Rosaceae
<i>Prunus serotina</i>	Rosaceae
<i>Prunus spinosa</i>	Rosaceae
<i>Psoralegium tenuiflorum</i>	Fabaceae
<i>Pycnostachya albescens</i>	Lamiaceae
<i>Quercus alba</i>	Fagaceae
<i>Quercus marilandica</i>	Fagaceae
<i>Quercus prinoides</i>	Fagaceae
<i>Quercus rubra</i>	Fagaceae
<i>Quercus stellata</i>	Fagaceae
<i>Quercus velutina</i>	Fagaceae
<i>Rhamnus caroliniana</i>	Rhamnaceae
<i>Rhus aromatica</i>	Anacardiaceae
<i>Rhus copallina</i>	Anacardiaceae
<i>Rhus glabra</i>	Anacardiaceae

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas (cont.).

Scientific Name	Family
Rhynchosia latifolia	Fabaceae
Robinia pseudo-acacia	Fabaceae
Rosa caroliniana	Rosaceae
Rubus flagellaris	Rosaceae
Rubus trivialis	Rosaceae
Rudbeckia hirta	Asteraceae
Rudbeckia missouriensis	Asteraceae
Rudbeckia triloba	Asteraceae
Ruellia humilis	Acanthaceae
Ruellia pedunculata	Acanthaceae
Sabatia angularis	Gentianaceae
Salvia azurea	Lamiaceae
Salvia lyrata	Lamiaceae
Sanicula canadensis	Apiaceae
Sassafras albidum	Lauraceae
Satureja arkansana	Lamiaceae
Schizachyrium scoparium	Poaceae
Schrankia uncinata	Fabaceae
Scleria oligantha	Cyperaceae
Scutellaria ovata	Lamiaceae
Scutellaria parvula	Lamiaceae
Sedum pulchellum	Crassulaceae
Senecio aureus	Asteraceae
Silene virginica	Caryophyllaceae
Silphium laciniatum	Asteraceae
Silphium terebinthinaceum	Asteraceae
Sisyrinchium campestre	Iridaceae
Smilax bona-nox	Liliaceae
Smilax rotundifolia	Liliaceae
Solidago hispida	Asteraceae
Solidago nemoralis	Asteraceae
Solidago odora	Asteraceae
Solidago ulmifolia	Asteraceae
Spiranthes lacera gracilis	Orchidaceae
Sporobolus vaginiflorus	Poaceae
Stylosanthes biflora	Fabaceae
Symphoricarpos orbiculatus	Caprifoliaceae
Taenidia integerrima	Apiaceae
Talinum parviflorum	Portulacaceae

Appendix 2. Vascular plants of the Lower Buffalo Wilderness savannas (cont.).

Scientific Name	Family
<i>Tephrosia virginiana</i>	Fabaceae
<i>Thaspium trifoliatum</i>	Apiaceae
<i>Thelesperma filifolium</i>	Asteraceae
<i>Toxicodendron radicans</i>	Anacardiaceae
<i>Tradescantia ohiensis</i>	Commelinaceae
<i>Tragia betonicifolia</i>	Euphorbiaceae
<i>Trichostema dichotomum</i>	Lamiaceae
<i>Tridens flavus</i>	Poaceae
<i>Triodanus perfoliata</i>	Campanulaceae
<i>Ulmus alata</i>	Ulmaceae
<i>Vaccinium arboreum</i>	Ericaceae
<i>Vaccinium pallidum</i>	Ericaceae
<i>Vaccinium stamineum</i>	Ericaceae
<i>Verbena canadensis</i>	Verbenaceae
<i>Verbena simplex</i>	Verbenaceae
<i>Verbesina helianthoides</i>	Asteraceae
<i>Verbesina virginica</i>	Asteraceae
<i>Vernonia crinita</i>	Asteraceae
<i>Viburnum rufidulum</i>	Caprifoliaceae
<i>Viola pedata</i>	Violaceae
<i>Vitis aestivalis</i>	Vitaceae
<i>Vitis cinerea</i>	Vitaceae
<i>Vulpia octoflora</i>	Poaceae