

THE VASCULAR FLORA OF THE SALLY BULL
HOLLOW TRACT OF THE OZARK
PLATEAU NATIONAL WILDLIFE
REFUGE, ADAIR COUNTY,
OKLAHOMA

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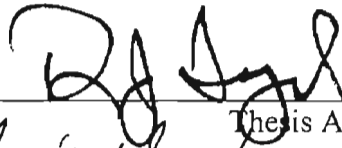
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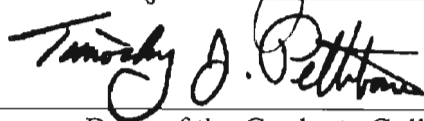
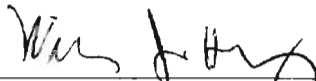
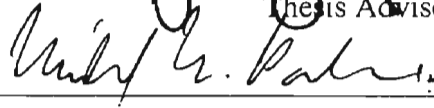
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Thesis Approved:



Thesis Advisor



Dean of the Graduate College

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TABLE OF CONTENTS

	Page
Abstract	1
Introduction	1
Characteristics of the Sally Bull Hollow Tract	3
Inventory of the Flora	5
Results and Discussion	5
Literature Cited	28

APPENDICES

A. Monthly Precipitation Data	31
B. Monthly Temperature Data	32

LIST OF TABLES AND FIGURES

TABLES	Page
1. Number of families, genera, and species in the Sally Bull Hollow Tract of the Ozark Plateau National Wildlife Refuge	9
2. Vascular plant taxa of the Sally Bull Hollow Tract of the Ozark Plateau National Wildlife Refuge.....	10

FIGURES	Page
1. Location of the Sally Bull Hollow Tract.....	30

ABSTRACT

Two hundred nineteen vascular plant species in 145 genera and 62 families were encountered in a two-year floristic inventory of the 810-ha Sally Bull Hollow Tract of the Ozark Plateau National Wildlife Refuge in Adair County, Oklahoma. Two hundred (91.3%) of the species were native. The Asteraceae and Poaceae were the largest families, and constituted 27% of the tract's flora. The discovery of *Carex gracilescens* – a species reported to occur in Oklahoma but not documented in state herbaria – confirms the occurrence of the taxon in the state.

INTRODUCTION

The Ozark Plateau National Wildlife Refuge (OPNWR), formerly known as the Oklahoma Bat Caves National Wildlife Refuge, consists of five tracts of land in Adair, Delaware, and Cherokee County, Oklahoma (U.S. Fish & Wildlife Service, 2002). The United States Fish and Wildlife Service (FWS) established the refuge in 1985 to protect several cave-dwelling species including *Corynorhinus townsendii ingens* (Ozark big-eared bat), *Myotis grisescens* (Gray bat), *Myotis sodalis* (Indiana bat), *Cambarus aculabrum* (Cave crayfish), *Amblyopsis rosae* (Ozark cavefish), and *Noturus placidus* (Neosho madtom). Seventeen plant species classified as rare, for example, *Custanea pumila* var. *ozarkensis* (Ozark chinquapin) and *Cacalia muehlenbergii* (great Indian-plantain), by the Oklahoma Natural Heritage Inventory (1997) also occur in these three counties.

The FWS is using an ecosystem approach to preserve these endangered animal species and maintain the forest habitat found in the area. The entire biota of the refuge,

not just the rare or imperiled species, is of concern. Therefore floristic data, as well as knowledge of the fauna, are necessary to preserve the natural ecosystem of the refuge.

The Sally Bull Hollow Tract (SBHT) is the largest of the five tracts that compose the refuge. It is an 810-ha site in eastern Adair County (Fig.1), and contains numerous cave entrances, which were gated in 2001 and 2002. The vegetation of the tract is predominately oak-hickory forest (Bruner, 1931; Duck and Fletcher, 1943, 1945). The overstory is dominated by *Quercus stellata* (post oak), *Q. velutina* (black oak), *Q. marilandica* (blackjack oak), and *Carya cordiformis* (bitternut hickory). Common woody understory taxa include *Cornus florida* (flowering dogwood), *Ulmus alata* (winged elm), and *Cercis canadensis* (eastern redbud). Common herbaceous understory taxa are *Chasmanthium latifolium* (indian woodoats), *Podophyllum peltatum* (mayapple), and *Vernonia baldwinii* (Baldwin's ironweed).

Our knowledge of the historical use of the SBHT is sketchy (S. Hensely, personal communication). Owned at one time by a timber company, it was logged to an unknown extent. Areas of the narrow bottomland along the creek were farmed at various times and small groups of grazing cattle periodically wander throughout the tract. Parts of the tract occasionally burn as the result of wildfires, but there has been no prescribed burning. In the 1950s, Charles Wallis conducted the only intensive floristic work on the county as a part of his doctoral study on the vascular plants of the Oklahoma Ozarks (Wallis, 1959). Collecting 328 species in 70 families, he botanized mostly along roadsides and in selected areas.

Because of this lack of knowledge about the vascular flora of the refuge, a floristic survey of the SBHT was undertaken. Specific objectives were four: (1) to

compile a list of the species present; (2) to estimate the relative abundance of each species; (3) to provide, using GPS coordinates, the geographical locations of the species listed as “rare” by the Oklahoma Natural Heritage Inventory (1997); and (4) to prepare voucher specimens documenting the species present.

CHARACTERISTICS of the SALLY BULL HOLLOW TRACT

The 810-ha Sally Bull Hollow Tract (35.72°N, 94.55°W) is situated in the Boston Mountains geomorphic province at the southwest edge of the Ozark Plateau (Curtis and Ham, 1972). A deeply dissected plateau, the province is characterized by Pennsylvanian sedimentary rock, primarily marine shales with sandstones and limestones (Branson and Johnson, 1972). Topography of the tract comprises two meandering ridges oriented from Northeast to Southwest, with a narrow valley (the hollow) between them. The tops of the ridges are approximately 200 m above the valley floor, along which a small, spring-fed, intermittent stream flows. The tract is infiltrated with a network of caves. Elevation ranges from approximately 300 m to 500 m, and the variation in slope and aspect permit a diversity of species to live and thrive in a small area.

The Soil Conservation Service (1965) characterized the tract as containing four soil series – Hector, Linker, Etowah, and Greendale – and three associations – Hector, Hector-Linker, and Etowah-Greendale. All of these soils are associated with hardwood forests. The Hector series dominates the tract. A lithosol, it consists of very shallow to shallow, gently sloping to steep, moderately coarse soils that arise from sandstone. Drainage is good to excessive. In the tract, the Linker series is found only in conjunction with the Hector series. A red-yellow podzol, it consists of moderately deep, moderately

coarse soils derived from sandstone and found in gently to moderately sloping areas with good drainage. The Etowah and Greendale series are associated throughout the hollow. These soils are associated with alluvial action and talus from cherty limestone. They occupy moderate to steep slopes, and contain large amounts of gravel.

The climate of the SBHT is warm temperate – cool winters and hot humid summers. Rapid changes in temperature are common due to weather systems influenced by southerly winds from the Gulf of Mexico and the influence of the Rocky Mountains (Johnson and Duchon, 1995). Temperature varies considerably throughout the growing season. For example, it can dip below freezing at the beginning of April and be above 40°C in July and August (Oklahoma Climatological Survey, 2002; Appendix A). In Adair County, the growing season is about 203 days, with the last spring freeze about 8 April and the first fall freeze about 28 October (Johnson and Duchon, 1995). Mean annual precipitation for the area is 111 cm (Oklahoma Climatological survey, 2002). March and April are typically the wettest months, whereas August and September are the driest (Appendix B). Like temperature, annual precipitation can vary considerably. The town of Stilwell, located 11.2 km northwest of the SBHT received 130 cm of precipitation in 2001, but only 107 cm in 2002 (Oklahoma Climatological Survey, 2002). In this area the wettest year was 1973 with 201.5 cm of precipitation, and the driest year 1963 with 61.9 cm (National Climatic Data Center, 2003).

FLORA of the SALLY BULL HOLLOW TRACT

Inventory of the vascular flora of the SBHT was conducted during the 2001 and 2002 growing seasons. Beginning in March of each year, the tract was traversed monthly on

foot by one or two individuals for a total of 14 trips. As species were encountered, their names were recorded and two voucher specimens, typically in fertile condition, collected. Observations of their morphology and ecology were also recorded. Their relative abundance was estimated 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.

Identification of plants not immediately recognized was via traditional taxonomic methods, i.e., use of keys, descriptions, and herbarium specimens (Radford et al., 1974). Taxa were identified to species; distinctions between subspecific taxa were not made. Nomenclature of both scientific and common names, and designation as an introduced species follows the PLANTS database (USDA NRCS, 1999). For common names typically used in Oklahoma refer to Taylor and Taylor (1994). This flora follows the standards set forth by Palmer et al. (1995).

One set of the voucher specimens was deposited in the Oklahoma State University Herbarium (OKLA) and the other given to the OPNWR's manager. Duplicate specimens of species of *Carex* were deposited in the Robert Bebb Herbarium at the University of Oklahoma (OKL).

RESULTS and DISCUSSION

Two hundred nineteen plant species were encountered in this inventory of the SBHT. They were representative of 4 classes, 62 families, and 145 genera (Table 1 & 2). The Asteraceae, represented by 25 genera and 35 species, and the Poaceae, represented by 10 genera and 23 species were the two most abundant families. Other large families

were the Fabaceae and the Rosaceae. The largest genera present in the tract were *Dichanthelium* (7 species) and *Quercus* (4 species). Two hundred (91.3%) of the species collected were native to North America.

Wallis (1959) collected 328 species in 70 families in 147,373-ha Adair County in his work in the 1950s. Species encountered in the tract but not collected by Wallis included: *Carex gracilescens* (Slender looseflower sedge), *Cyperus echinatus* (globe flat sedge), *Scutellaria ovata* (heartleaf skullcap), *Elymus hystrix* (eastern bottlebrush grass), *Panicum philadelphicum* (Philadelphia panicgrass), *Enemion hiternatum* (eastern false rue anemone), and *Phryma leptostachya* (American lopseed). As was expected, because of the small size of the SBHT and its relatively few habitats, many species collected by Wallis were not present during the sampling period.

I collected nineteen introduced species: *Achillea millefolium*, *Barbarea vulgaris*, *Belamcanda chinensis*, *Bromus japonicus*, *Commelina communis*, *Dianthus armeria*, *Kummerowia stipulacea*, *Lonicera japonica*, *Poa annua*, *Polygonum convolvulus*, *Rosa multiflora*, *Spiraea prunifolia*, *Stellaria media*, *Taraxacum officinale*, *Torilis arvensis*, *Trifolium campestre*, *Trifolium repens*, *Verbascum blattaria*, and *Melilotus alba*. These were encountered primarily along the few trails that wind through the tract. Their introduction is likely due primarily to fruit and seed dispersal via human recreational activities. Although the SBHT is not currently open to the public, local residents often use its trails for horseback riding and four wheeling on all-terrain vehicles. Though several of these species, e.g. *Lonicera japonica* (Japanese honeysuckle), are of concern elsewhere because of their invasiveness, they currently do not appear to be a threat to the native vegetation of the tract.

The SBHT is dominated primarily by two types of forest, that found on the upland slopes and that found in the bottom of the hollow. The upland sites contain many cave entrances and limestone outcrops. There are also several locations where limestone boulders and bluffs occur. Openings in the canopy, which vary from less than 1 m to about 8 m in diameter, are present throughout out the upland forest. The larger open areas often have different herbaceous species in them in contrast to those areas under the canopy. Some of the species in the open include *Cirsium altissimum* (tall thistle) and *Eryngium yuccifolium* (rattlesnake master). Several species were encountered only in the upland areas. These include, *Ostrya virginiana* (hophornbeam), *Rhus copallina* (winged sumac), *Ulmus alata* (winged sumac), *Juniperus virginiana* (eastern red cedar) and *Fragaria virginiana* (Virginia strawberry).

Several features distinguish the hollow from the uplands. The intermittent stream dominates much of the hollow, but its banks vary. In some areas, the bank is broad, flat, and extends 10-15 m before the steep slopes of the ridges begin. In other areas, the bank is narrow and the slope begins immediately. In one spot, the stream abuts a limestone wall over 15 m high. Several species of ferns grow in the crevices of this wall, along with many mosses and liverworts. Several species were encountered only in the hollow bottom; these include *Gleditsia triacanthos* (honey locust), *Asimina triloba* (pawpaw), *Acer negundo* (boxelder), *Chasmanthium latifolium* (Indian woodoats), and *Adiantum capillus-veneris* (common maiden hair fern).

The ten plant species designated rare in Adair County by the Oklahoma Heritage Inventory (2000) were not encountered in the SBHT. *Pinus echinata* (shortleaf pine) was also unexpectedly absent. Despite the presence of a *Pinus echinata-Quercus alba-Q.*

velutina forest association in Adair County (Hoagland, 2000), and the presence of *P. echinata* on ridge tops throughout the surrounding area, the taxon was not encountered in the SBHT. The discovery of *Carex gracilescens* – a species reported to occur in Oklahoma but not previously documented in state herbaria – confirms the occurrence of the taxon in the state. The 219 species in the SBHT constitute 8.6% of the 2,540 vascular species found in Oklahoma (Tyrl et al., 2003). Almost 17% of the genera in the state are found in the Tract, as well as 35.8% of the families.

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Table 1. Number of families, genera, and species in the Sally Bull Hollow Tract of the Ozark Plateau National Wildlife Refuge; distinctions between subspecific taxa were not made.

Taxonomic group	Families	Genera	Species		
			Native	Introduced	Total
Pteridophyta	4	6	6	0	6
Coniferophyta	1	1	1	0	
Magnoliophyta					
Liliopsida	7	8	37	4	41
Magnoliopsida	50	130	156	15	171
Total	62	145	200	19	219

Table 2. Vascular plant taxa of the Sally Bull Hollow Tract of the Ozark Plateau National Wildlife Refuge, Adair County, OK. Nomenclature follows the PLANTS Database (USDA, NRCS, 1999). Taxa are arranged alphabetically by family, and species. Abundance is according to Palmer et al. (1995). U.S. Nativity indicates if a species is native to North America or is introduced. PLANTS Symbol is the identification code assigned to each species listed in PLANTS database.

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Acanthaceae					
	<i>Ruellia pedunculata</i> Torr. ex Gray	stalked wild petunia	Occasional	Native	RUPE4
Accraceae					
	<i>Acer negundo</i> L.	boxelder	Occasional	Native	ACNEN
	<i>Acer rubrum</i> L.	red maple	Frequent	Native	ACRU
	<i>Acer saccharum</i> Marsh.	sugar maple	Frequent	Native	ACSA3
Anacardiaceae					
	<i>Rhus aromatica</i> Alt.	fragrant sumac	Frequent	Native	RHAR4
	<i>Rhus copallina</i> Engl.	winged sumac	Frequent	Native	RHCOL2
	<i>Rhus glabra</i> L.	smooth sumac	Frequent	Native	RHGL
	<i>Toxicodendron radicans</i> (L.) Kuntze	eastern poison ivy	Frequent	Native	TORA2
Annonaceae					
	<i>Asimina triloba</i> (L.) Dunal	pawpaw	Occasional	Native	ASTR

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Apiaceae					
	<i>Chaerophyllum tainturieri</i> Hook.	hairyfruit chervil	Infrequent	Native	CHTA
	<i>Eryngium yuccifolium</i> Michx.	button eryngo	Infrequent	Native	ERYU
	<i>Sanicula odorata</i> (Raf.) K.M. Pryer & L.R. Phillippe	clustered blacksnakeroot		Native	SAOD
	<i>Torilis arvensis</i> (Huds.) Link	spreading hedgeparsley	Occasional	Introduced	TORA
Aquifoliaceae					
	<i>Ilex decidua</i> Walt.	possumhaw	Occasional	Native	ILDE
Asclepiadaceae					
	<i>Asclepias quadrifolia</i> Jacq.	fourleaf milkweed	Occasional	Native	ASQU
	<i>Asclepias variegata</i> L.	redring milkweed	Occasional	Native	ASVA
	<i>Asclepias verticillata</i> L.	whorled milkweed	Occasional	Native	ASVE
	<i>Matelea baldwyniana</i> (Sweet) Woods.	Baldwin's milkvine	Infrequent	Native	MABA3
Aspleniaceae					
	<i>Asplenium platyneuron</i> (L.) B.S.P.	ebony spleenwort	Rare	Native	ASPL
Asteraceae					
	<i>Achillea millefolium</i> L.	common yarrow	Frequent	Both ⁱ	ACMI2

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Ageratina altissima</i> (L.) King & H.E. Robins	white snakeroot	Occasional	Native	AGALA
	<i>Ambrosia psilostachya</i> DC.	Cuman ragweed	Frequent	Native	AMPS
	<i>Ambrosia trifida</i> L.	great ragweed	Frequent	Native	AMTR
	<i>Antennaria parlinii</i> Fern.	Parlin's pussy toes	Infrequent	Native	ANPAP
	<i>Astranthium integrifolium</i> (Michx.) Nutt.	entireleaf western daisy	Infrequent	Native	ASIN9
	<i>Chrysopsis pilosa</i> Nutt	soft goldenaster	Occasional	Native	CHPL8
	<i>Cirsium altissimum</i> (L.) Hill	tall thistle	Infrequent	Native	CLAL2
	<i>Conyza canadensis</i> (L.) Cronq.	Canadian horseweed	Frequent	Native	COCA5
	<i>Coreopsis pubescens</i> Ell.	startickseed		Native	COPU2
	<i>Echinacea purpurea</i> (L.) Moench	eastern purple coneflower	Frequent	Native	ECPU
	<i>Elephantopus carolinianus</i> Raeusch.	Carolina elephantsfoot	Frequent	Native	ELCA3
	<i>Erigeron strigosus</i> Muhl. ex Willd.	prairie fleabane	Frequent	Native	ERST3
	<i>Fleischmannia incarnata</i> (Walt.) King & H.E. Robins.	pink thoroughwort	Occasional	Native	FLIN2
	<i>Grindelia papposa</i> Nesom & Suh	Spanish gold	Occasional	Native	GRPA8
	<i>Grindelia squarrosa</i> (Pursh) Dunal	curlycup gumweed	Occasional	Native	GRSQ

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Helenium amarum</i> (Raf.) H. Rock	yellowdicks	Frequent	Native	HEAM
	<i>Helianthus hirsutus</i> Raf.	hairy sunflower	Frequent	Native	HEHI2
	<i>Heliopsis helianthoides</i> (L.) Sweet	smooth oxeye	Occasional	Native	HEHE5
	<i>Hieracium gronovii</i> L.	queendevil	Occasional	Native	HIGR3
	<i>Lactuca canadensis</i> L.	Canada lettuce	Occasional	Native	LACA
	<i>Parthenium integrifolium</i> L.	wild quinine	Occasional	Native	PAIN3
	<i>Polymnia canadensis</i> L.	whiteflower leafcup	Infrequent	Native	POCA11
	<i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & Burt	rabbittobacco	Occasional	Native	PSOB3
	<i>Pyrrhopappus carolinianus</i> (Walt.) DC.	Carolina desert chicory	Infrequent	Native	PYCA2
	<i>Ratibida pinnata</i> (Vent.) Barnh.	pinnate prairie coneflower	Occasional	Native	RAPI
	<i>Rudbeckia hirta</i> L.	blackeyed Susan	Occasional	Native	RUHI2
	<i>Rudbeckia laciniata</i> L.	cutleaf coneflower	Occasional	Native	RULA3
	<i>Solidago hispida</i> Muhl. ex Willd.	hairy goldenrod	Occasional	Native	SOHI
	<i>Solidago radula</i> Nutt.	western rough goldenrod	Frequent	Native	SORA
	<i>Solidago ulmifolia</i> Muhl. ex Willd.	elmleaf goldenrod	Occasional	Native	SOUL2
	<i>Symphotrichum anomalum</i> (Engelm.) Nesom	manyray aster	Infrequent	Native	SYAN2

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Symphyotrichum drummondii</i> (Lindl.) Nesom	Drummond's aster	Occasional	Native	STDRD
	<i>Taraxacum officinale</i> G.H. Weber ex Wiggers	common dandelion	Occasional	Introduced	TAOF
	<i>Verbesina alternifolia</i> (L.) Britt. ex Kearney	wingstem	Infrequent	Native	VEAL
	<i>Vernonia baldwinii</i> Torr.	Baldwin's ironweed	Frequent	Native	VEBA
Balsaminaceae					
	<i>Impatiens capensis</i> Meerb.	jewelweed	Infrequent	Native	IMCA
Berberidaceae					
	<i>Podophyllum peltatum</i> L.	mayapple	Frequent	Native	POPE
Betulaceae					
	<i>Ostrya virginiana</i> (P. Mill.) K. Koch	hophornbeam	Occasional	Native	OSVI
Brassicaceae					
	<i>Barbarea vulgaris</i> Ait. f.	garden yellowrocket	Occasional	Introduced	BAVU
	<i>Cardamine concatenata</i> (Michx.) Sw.	cutleaf toothwort	Occasional	Native	CACO26
	<i>Lepidium virginicum</i> L.	Virginia pepperweed	Frequent	Native	LEVI3

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Campanulaceae					
	<i>Campanulastrum americanum</i> (L.)	small American bellflower	Occasional	Native	CAAM18
	<i>Lobelia appendiculata</i> A. DC.	pale lobelia	Infrequent	Native	LOAP
	<i>Lobelia inflata</i> L.	Indian-tobacco	Infrequent	Native	LOIN
	<i>Lobelia siphilitica</i> L.	great blue lobelia	Infrequent	Native	LOSI
	<i>Triodanis perfoliata</i> (L.) Nieuwl.	clasping Venus' looking-glass	Infrequent	Native	TRPE4
Caprifoliaceae					
	<i>Lonicera japonica</i> Thunb	Japanese honeysuckle	Infrequent	Introduced	LOJA
	<i>Symphoricarpos orbiculatus</i> Moench.	coralberry	Occasional	Native	SYOR
Caryophyllaceae					
	<i>Dianthus armeria</i> L.	Deptford pink	Infrequent	Introduced	DIAR
	<i>Silene stellata</i> (L.) Ait. f.	widow'sfrill	Occasional	Native	SIST
	<i>Silene virginica</i> L.	fire pink	Infrequent	Native	SIVI4
	<i>Stellaria media</i> (L.) Vill.	common chickweed	Infrequent	Introduced	STME2
Celastraceae					
	<i>Euonymus atropurpurea</i> Jacq.	eastern wahoo	Occasional	Native	EUAT3

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Clusiaceae					
	<i>Hypericum hypericoides</i> (L.) Crantz	St. Andrew's cross	Occasional	Native	HYHY
	<i>Hypericum punctatum</i> Lam.	spotted St. Johnswort	Occasional	Native	HYPU
Commelinaceae					
	<i>Commelina communis</i> L.	Asiatic dayflower	Infrequent	Introduced	COCO3
	<i>Tradescantia ozarkana</i> E.S. Anderson & Woods.	Ozark spiderwort	Occasional	Native	TROZ
Convolvulaceae					
	<i>Ipomoea pandurata</i> (L.) G.F.W. Mey.	man of the earth	Infrequent	Native	IPPA
Cornaceae					
	<i>Cornus drummondii</i> C.A. Mey.	roughleaf dogwood	Infrequent	Native	CORD
	<i>Cornus florida</i> L.	flowering dogwood	Occasional	Native	COFL2
Cupressaceae					
	<i>Juniperus virginiana</i> L.	eastern redcedar	Infrequent	Native	JUVI
Cuscutaceae					
	<i>Cuscuta pentagona</i> Engelm.	fiveangled dotter	Infrequent	Native	CUPE3

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Cyperaceae					
	<i>Carex cephalophora</i> Muhl. ex Willd.	oval-leaf sedge	Occasional	Native	CACE
	<i>Carex gracilescens</i> Steud.	slender looseflower sedge	Rare	Native	CAGR8
	<i>Carex muehlenbergii</i> Schkuhr ex Willd.	Muhlenberg's sedge	Infrequent	Native	CAMU4
	<i>Cyperus echinatus</i> (L.) Wood	globe flatsedge	Occasional	Native	CYEC2
	<i>Scirpus pendulus</i> Muhl.	rufous bulrush	Infrequent	Native	SCPE4
	<i>Scleria oligantha</i> Michx.	littlehead nutrush	Infrequent	Native	SCOL2
Dioscoreaceae					
	<i>Dioscorea villosa</i> L.	wild yam	Infrequent	Native	DIVI4
Dryopteridaceae					
	<i>Dryopteris filix-mas</i> (L.) Schott	male fern	Infrequent	Native	DRFI2
	<i>Polystichum acrostichoides</i> (Michx.) Schott	Christmas fern	Occasional	Native	POAC4
	<i>Woodsia obtusa</i> (Spreng.) Torr.	bluntlobe cliff fern	Occasional	Native	WOOB2
Euphorbiaceae					
	<i>Acalypha gracilens</i> Gray	slender threeseed mercury	Occasional	Native	ACGR2
	<i>Croton monanthogynus</i> Michx.	prarie tea	Occasional	Native	CRMO6
	<i>Euphorbia corollata</i> L.	flowering spurge	Occasional	Native	EUCO10

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Fabaceae					
	<i>Cercis canadensis</i> L.	eastern redbud	Occasional	Native	CECA4
	<i>Chamaecrista fasciculata</i> (Michx.) Greene	sleepingplant	Frequent	Native	CHFA2
	<i>Desmodium canadense</i> (L.) DC.	showy ticktrefoil	Frequent	Native	DECA7
	<i>Desmodium glutinosum</i> (Muhl. ex Willd.) Wood	pointedleaf ticktrefoil	Frequent	Native	DEGL5
	<i>Desmodium nudiflorum</i> (L.) DC.	nakedflower ticktrefoil	Frequent	Native	DENU4
	<i>Desmodium pauciflorum</i> (Nutt.) DC.	fewflowered ticktrefoil	Frequent	Native	DEPA7
	<i>Gleditsia triacanthos</i> L.	honeylocust	Occasional	Native	GLTR
	<i>Kummerowia stipulacea</i> (Maxim.) Makino	Korean clover	Occasional	Introduced	KUST
	<i>Lespedeza repens</i> (L.) W. Bart.	creeping lespedeza	Infrequent	Native	LERE2
	<i>Lespedeza violacea</i> (L.) Pers.	violet lespedeza	Infrequent	Native	LEVI6
	<i>Lespedeza virginica</i> (L.) Britt.	slender lespedeza	Occasional	Native	LEVI7
	<i>Melilotus alba</i> Medikus	white sweetclover	Occasional	Introduced	MEAL12
	<i>Mimosa quadrivalvis</i> L.	fourvalve mimosa	Occasional	Native	MIQU2

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Orbexilum pedunculatum</i> (P. Mill.) Rydb.	Sampson's snakeroot	Infrequent	Native	ORPE
	<i>Strophostyles umbellata</i> (Muhl. ex Willd.) Britt	pink fuzzybean	Infrequent	Native	STUM2
	<i>Stylosanthes biflora</i> (L.) B.S.P.	sidebeak pencilflower	Occasional	Native	STBI2
	<i>Tephrosia virginiana</i> (L.) Pers.	Virginia tephrosia	Frequent	Native	TEVI
	<i>Trifolium campestre</i> Schreb.	field clover	Occasional	Introduced	TRCA5
	<i>Trifolium repens</i> L.	white clover	Occasional	Introduced	TRRE3
Fagaceae					
	<i>Quercus alba</i> L.	white oak	Abundant	Native	QUAL
	<i>Quercus macrocarpa</i> Michx.	bur oak	Abundant	Native	QUMA2
	<i>Quercus marilandica</i> Muenchh.	blackjack oak	Abundant	Native	QUMA3
	<i>Quercus rubra</i> L.	northern red oak	Abundant	Native	QURU
Fumariaceae					
	<i>Corydalis micrantha</i> Engelm. ex Gray	smallflower fumewort	Occasional	Native	COMI2
Hydrangeaceae					
	<i>Hydrangea arborescens</i> L.	wild hydrangea	Occasional	Native	HYAR

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Iridaceae	<i>Belamcanda chinensis</i> (L.) DC.	blackberry lily	Rare	Introduced	BECH
Juglandaceae	<i>Carya alba</i> (L.) Nutt. ex Ell.	mockernut hickory	Abundant	Native	CAAL27
	<i>Carya cordiformis</i> (Wangenh.) K. Koch	bitternut hickory	Abundant	Native	CACO15
	<i>Juglans nigra</i> L.	black walnut	Frequent	Native	JUNI
Juncaceae	<i>Juncus interior</i> Wieg.	inland rush	Infrequent	Native	JUIN2
	<i>Luzula bulbosa</i> (Wood) Smyth & Smyth	bulbous woodrush	Occasional	Native	LUBU
Lamiaceae	<i>Blephilia ciliata</i> (L.) Benth.	downy pagoda-plant	Frequent	Native	BLCI
	<i>Cunila origanoides</i> (L.) Britt.	common ditany	Frequent	Native	CUOR
	<i>Isanthus brachiatus</i> (L.) B.S.P.	fluxweed	Infrequent	Native	ISBR3
	<i>Lamium purpureum</i> L.	purple deadnettle	Occasional	Introduced	LAPU2
	<i>Monarda fistulosa</i> L.	wild bergamot	Frequent	Native	MOFI
	<i>Monarda russeliana</i> Nutt. ex Sims	redpurple beebalm	Frequent	Native	MORU
	<i>Prunella vulgaris</i> L.	common selfheal	Occasional	Native	PRVU

<u>Family</u>	<u>Species</u>	<u>Common Name</u>	<u>Abundance</u>	<u>U.S. Nativity</u>	<u>PLANTS Symbol</u>
	<i>Pycnanthemum albescens</i> Torr. & Gray	whiteleaf mountainmint	Infrequent	Native	PYAL
	<i>Pycnanthemum tenuifolium</i> Schrad.	narrowleaf mountainmint	Occasional	Native	PYTE
	<i>Scutellaria elliptica</i> Muhl.ex Spreng.	hairy skullcap	Occasional	Native	SCEL
	<i>Scutellaria ovata</i> Hill	heartleaf skullcap	Occasional	Native	SCOV
Lauraceae					
	<i>Lindera benzoin</i> (L.) Blume	northern spice bush	Frequent	Native	LIBE3
	<i>Sassafras albidum</i> (Nutt.) Nees.	sassafras	Frequent	Native	SAAL5
Liliaceae					
	<i>Allium canadense</i> L.	meadow garlic	Frequent	Native	ALCA3
	<i>Erythronium albidum</i> Nutt.	white fawnlily	Frequent	Native	ERAL9
	<i>Nothoscordum bivalve</i> (L.) Britt.	crowposion	Occasional	Native	NOBI2
	<i>Trillium viridescens</i> Nutt.	tapertip wakerobin	Frequent	Native	TRVI5
	<i>Uvularia grandiflora</i> Sm.	largeflower bellwort	Occasional	Native	UVGR
Lythraceae					
	<i>Cuphea viscosissima</i> Jacq.	blue waxweed	Infrequent	Native	CUVI
Moraceae					
	<i>Morus rubra</i> L.	red mulberry	Occasional	Native	MORU2

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Onagraceae	<i>Oenothera fruticosa</i> L.	narrowleaf evening-primrose	Infrequent	Native	OEFR
Papaveraceae	<i>Sanguinaria canadensis</i> L.	bloodroot	Frequent	Native	ASCA13
Phytolaccaceae	<i>Phytolacca americana</i> L.	American pokeweed	Abundant	Native	PHAM4
Plantaginaceae	<i>Plantago major</i> L.	common plantain	Occasional	Native	PLMA2
Platanaceae	<i>Platanus occidentalis</i> L.	American sycamore	Frequent	Native	PLOC
Poaceae	<i>Andropogon virginicus</i> L.	broomsedge bluestem	Infrequent	Native	ANVI2
	<i>Arundinaria gigantea</i> (Walt.) Muhl.	giant cane	Rare	Native	ARGI
	<i>Bromus japonicus</i> Thunb. ex Murr.	Japanese brome	Infrequent	Introduced	BRJA
	<i>Bromus pubescens</i> Muhl. ex Willd.	hairy woodland brome	Infrequent	Native	BRPU6
	<i>Chasmanthium latifolium</i> (Michx.) Yates	Indian woodoats	Abundant	Native	CHLA5
	<i>Danthonia spicata</i> (L.) Beauv. ex Roemer & J.A. Schultes	Poverty oatgrass	Occasional	Native	DASP2

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Diarrhena americana</i> Beauv.	American beakgrain	Infrequent	Native	DIAM
	<i>Diarrhena obovata</i> (Gleason) Brandenberg	obovate beakgrain	Infrequent	Native	DIOB3
	<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark	tapered rosette grass	Occasional	Native	DIAC2
	<i>Dichanthelium boscii</i> (Poir.) Gould & C.A. Clark	Bosc's panicgrass	Occasional	Native	DIBO2
	<i>Dichanthelium laxiflorum</i> (Lam.) Gould	openflower rosette grass	Infrequent	Native	DILA9
	<i>Dichanthelium ravenelii</i> (Scribn. & Merr.) Gould	Ravenel's rosette grass	Occasional	Native	DIRA
	<i>Dichanthelium sphaerocarpon</i> (Ell.) Gould	roundseed panicgrass	Occasional	Native	DISP2
	<i>Elymus hystrix</i> L.	eastern bottlebrush grass	Occasional	Native	ELYH
	<i>Elymus virginicus</i> L.	Virginia wildrye	Occasional	Native	ELVI3
	<i>Eragrostis hirsuta</i> (Michx.) Nees	bigtop lovegrass	Occasional	Native	ERHI
	<i>Muhlenbergia sobolifera</i> (Muhl. ex Willd.) Trin.	rocky muhly	Infrequent	Native	MUSO

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Panicum philadelphicum</i> Bernh. ex Trin.	Philadelphia panic grass	Occasional	Native	PAPH
	<i>Poa annua</i> L.	annual bluegrass	Rare	Introduced	POAN
	<i>Poa compressa</i> L.	Canada bluegrass	Infrequent	Introduced	POCO
	<i>Setaria parviflora</i> (Poir.) Kerguelen	marsh bristlegrass	Occasional	Native	SEPA10
	<i>Sphenopholis obtusata</i> (Michx.) Scribn.	prairie wedgescale	Infrequent	Native	SPOB
	<i>Tridens flavus</i> (L.) A.S. Hitchc.	purpletop tridens	Frequent	Native	TRFL2
Polemoniaceae	<i>Phlox divaricata</i> L.	wild blue phlox	Frequent	Native	PHHI5
Polygonaceae	<i>Polygonum convolvulus</i> L.	black bindweed	Occasional	Introduced	POCO10
	<i>Polygonum hydropiperoides</i> Michx.	swamp smartweed	Occasional	Native	POHY2
	<i>Polygonum pennsylvanicum</i> L.	Pennsylvania Smartweed	Occasional	Native	POPE2
	<i>Polygonum punctatum</i> Ell.	dotted smartweed	Occasional	Native	POPUS
	<i>Polygonum scandens</i> L.	climbing false buckwheat	Occasional	Native	POSC3
	<i>Polygonum setaceum</i> Baldw.	bog smartweed	Occasional	Native	POSE6

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Portulacaceae					
	<i>Claytonia virginica</i> L.	Virginia springbeauty	Frequent	Native	CLVI3
Pteridaceae					
	<i>Adiantum pedatum</i> L.	northern maidenhair	Occasional	Native	ADPE
Ranunculaceae					
	<i>Aquilegia canadensis</i> L.	red columbine	Infrequent	Native	AQCA
	<i>Clematis versicolor</i> Small ex Rydb.	pale leather flower	Infrequent	Native	CLVE
	<i>Enemion biternatum</i> Raf.	eastern false rue anemone	Occasional	Native	ENBI
	<i>Ranunculus micranthus</i> Nutt.	rock buttecup	Infrequent	Native	RAMI2
Rhamnaceae					
	<i>Ceanothus americanus</i> L.	New Jersey tea	Occasional	Native	CEAM
	<i>Frangula caroliniana</i> (Walt.) Gray	Carolina buckthorn	Occasional	Native	FRCA13
Rosaceae					
	<i>Agrimonia pubescens</i> Wallr.	soft agrimony	Infrequent	Native	AGPU
	<i>Fragaria virginiana</i> Duchesne	Virginia strawberry	Occasional	Native	FRVI
	<i>Geum canadense</i> Jacq.	white avens	Infrequent	Native	GECA7
	<i>Prunus mexicana</i> S. Wats.	Mexican plum	Occasional	Native	PRME
	<i>Rosa carolina</i> L.	Carolina rose	Infrequent	Native	ROCA4
	<i>Rosa multiflora</i> Thunb. ex Murr.	multiflora rose	Infrequent	Introduced	ROMU

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
	<i>Rubus allegheniensis</i> Porter	Allegheny blackberry	Occasional	Native	RUAL
	<i>Spiraea prunifolia</i> Sieb. & Zucc.	bridalwreath spirea	Rare	Introduced	SPPR
Rubiaceae					
	<i>Galium arkansanum</i> Gray	Arkansas bedstraw	Infrequent	Native	GAAR4
	<i>Houstonia purpurea</i> L.	Venus' pride	Infrequent	Native	HOPUP3
	<i>Houstonia pusilla</i> Schoepf	tiny bluet	Occasional	Native	HOPU3
Scrophulariaceae					
	<i>Collinsia violacea</i> Nutt.	violet blue eyed Mary	Occasional	Native	COVI2
	<i>Penstemon tubiflorus</i> Nutt.	white wand beardtongue	Occasional	Native	PETU
	<i>Scrophularia marilandica</i> L.	carpenter's square	Occasional	Native	SCMA2
	<i>Verbascum blattaria</i> L.	moth mullein	Occasional	Introduced	VEBL
Smilacaceae					
	<i>Smilax bona-nox</i> L.	saw greenbriar	Frequent	Native	SMBO2
	<i>Smilax herbacea</i> L.	smooth carrionflower	Frequent	Native	SMHE
Solanaceae					
	<i>Physalis pubescens</i> L.	husk tomato	Infrequent	Native	PHPU7
	<i>Solanum carolinense</i> L.	Carolina horsenettle	Occasional	Native	SOCA3
	<i>Solanum ptycanthum</i> Dunal	West Indian nightshade	Occasional	Native	SOPT3

Family	Species	Common Name	Abundance	U.S. Nativity	PLANTS Symbol
Staphyleaceae					
	<i>Staphylea trifolia</i> L.	American bladdernut	Infrequent	Native	STTR
Ulmaceae					
	<i>Celtis laevigata</i> Willd.	sugarberry	Frequent	Native	CELA
	<i>Ulmus alata</i> Michx.	winged elm	Frequent	Native	ULAL
Urticaceae					
	<i>Boehmeria cylindrica</i> (L.) Sw.	smallspike false nettle	Infrequent	Native	BOCY
Verbenaccae					
	<i>Glandularia canadensis</i> (L.) Nutt.	rose mock vervain	Occasional	Native	GLCA2
	<i>Phryma leptostachya</i> L.	American lopseed	Occasional	Native	PHLE5
Violaceae					
	<i>Viola sororia</i> Willd.	common blue violet	Frequent	Native	VISO
Vitaceae					
	<i>Parthenocissus quinquefolia</i> (L.) Planch	Virginia creeper	Abundant	Native	PAQU2
	<i>Vitis vulpina</i> L.	frost grape	Frequent	Native	VIVU

' PLANTS database lists taxon as both native and introduced. This reflects disagreement among taxonomists as to its origin.

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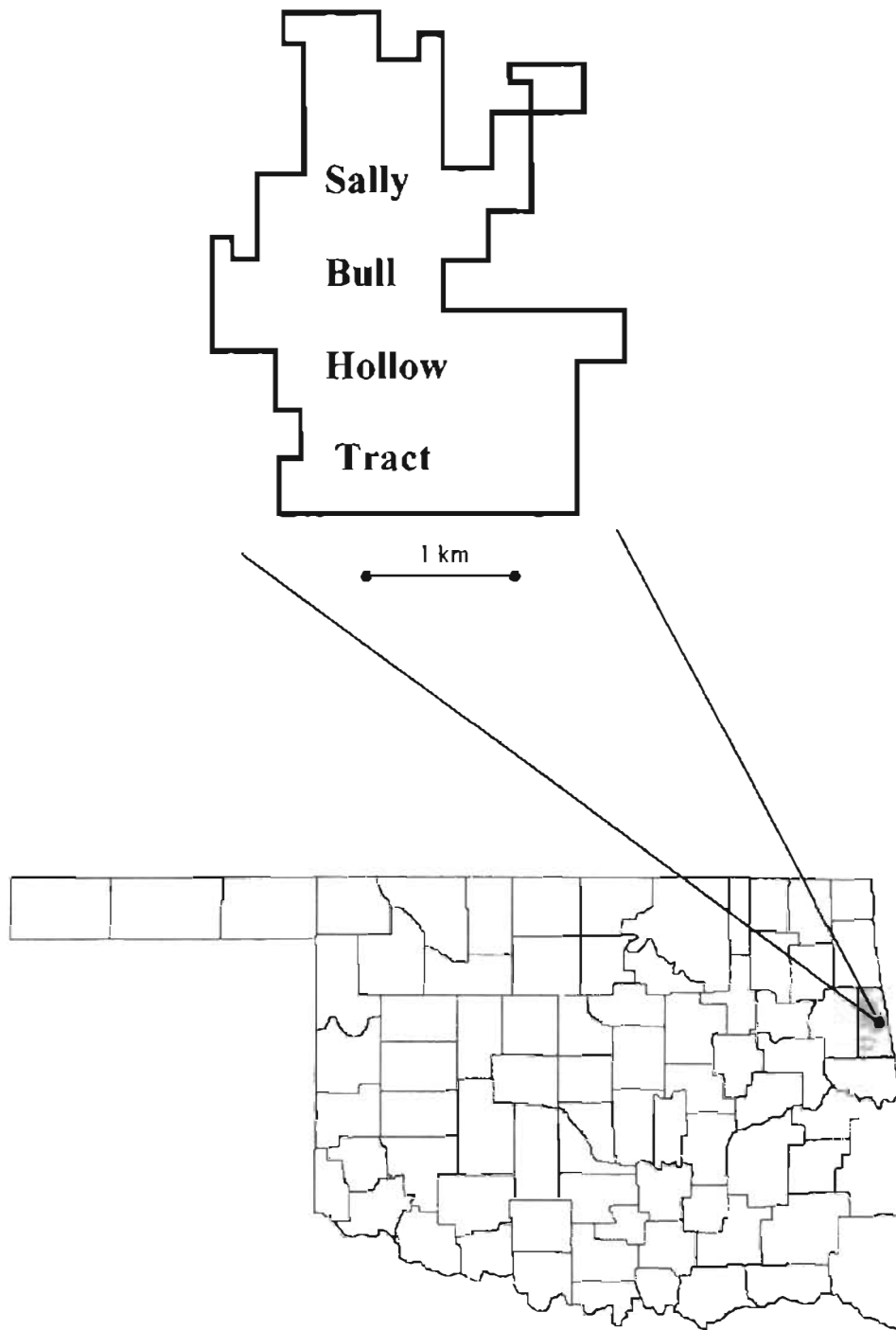


Figure 1. The Sally Bull Hollow Tract of the Ozark Plateau National Wildlife Refuge (35.72°N, 94.55°W), 11.2 km southeast of Stilwell, Adair County, OK.

Appendix A

Monthly precipitation and the deviation from mean precipitation amounts for each month in centimeters for 2001 and 2002; data are for Stilwell, OK approximately 11.2 km Northwest of the Sally Bull Hollow tract of the Ozark Plateau National Wildlife Refuge.

	2001		2002	
	Total Precipitation (cm)	Deviation from Mean (cm)	Total Precipitation (cm)	Deviation from Mean (cm)
January	7.42	+2.13	7.01*	**
February	18.36	+11.61	3.58	-3.43
March	4.65	-6.22	19.23*	**
April	5.72	-5.72	13.67	+1.5
May	19.74	+5.33	11.33	-3.81
June	11.89	+1.17	11.18	-1.93
July	3.89	-3.86	2.11	-6.05
August	13.49	+3.61	11.0*	**
September	10.77	-1.22	3.53	-8.84
October	12.60	+2.24	8.03*	**
November	10.54	0.94	1.70*	**
December	10.95	2.92	14.78*	**
TOTAL	130	12.93	107	**

* Data for Cookson mesonet site (Oklahoma Climatological Survey)

** No data available

Appendix B

Mean, maximum, and minimum monthly temperatures in degrees Celsius for 2001 and 2002; data are for Stilwell, OK approximately 11.2 km Northwest of the Sally Bull Hollow tract of the Ozark Plateau National Wildlife Refuge.

	2001			2002		
	Mean Temperature (Celsius)	Maximum Temperature (Celsius)	Minimum Temperature (Celsius)	Mean Temperature (Celsius)	Maximum Temperature (Celsius)	Minimum Temperature (Celsius)
January	0.78	13.9	-16.7	**	23.3*	-15*
February	5.2	19.4	-11.1	4.11	16.7	-11.7
March	**	23.3*	-4.4*	**	24.4*	-17.2*
April	17.1	29.4*	-1.7*	14.6	28.3	-0.6
May	18.8	32.2	5	17.8	30.6	3.3
June	22.5	31.6	5.6	22.8	31.7	11.1
July	27.6	37.8	16.1	25.6	35.5	15
August	26.7	38.9*	17.2*	**	36.7*	16.1*
September	20.6	32.2	3.9	22.8	34.4	6.7
October	14.1	26.7	-2.2	**	32.2*	-0.6*
November	11	23.3*	-5*	**	25*	-8.9*
December	5.7	20.6	-11.7	**	20.6*	-11.7*

* Data for Cookson mesonet site (Oklahoma Climatological Survey)

** No data available

VITA

#2

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Candidate for the degree of

Master of Science

Thesis: A STUDY OF THE VASCULAR PLANTS OF THE SALLY BULL HOLLOW TRACT OF THE OZARK PLATEAU NATIONAL WILDLIFE REFUGE, ADAIR COUNTY, OKLAHOMA

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