

**Floristic survey of The Nature Conservancy's  
Pennington Creek preserve in Johnston County, Oklahoma  
1997**

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**This study was conducted as one part of an overall biological assessment of The Nature Conservancy's Pennington Creek site. A 9.6 hectare area was surveyed during the 1995 and 1996 growing seasons for plants in fertile condition. They were collected, identified and voucher specimens were deposited in the OSU Herbarium (OKLA). Physiographic and ecological aspects of the site were described using Geographic Information System (GIS) techniques. Two hundred-three species representing 157 genera and 63 families were collected. Four plant communities are present: forest, grassland, granitic outcrop, and riparian. Characteristic taxa of the forest community include *Quercus stellata*, *Q. marilandica*, *Carya texana*, *C. cordiformis*, *Symphoricarpos orbiculatus*, and *Elymus canadensis*. *Tridens flavus*, *Setaria lutescens*, *Sorghastrum nutans* and *Gaillardia pulchella* are dominants found in the grasslands. The granitic outcrop areas provide habitat for: *Sedum pulchellum*, *S. nuttallianum*, *Krigia virginica*, *Chaetopappa asteroides*, and *Polypodium polypodioides*. Characteristic species of the riparian community include *Carex* spp., *Cyperus* spp., *Chasmanthium latifolium*, *Platanus occidentalis*, and *Alnus maritima*.**

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## INTRODUCTION

Floristic studies have long been an important means of understanding the plants, vegetation, and ecosystems that surround us. Traditionally floristic surveys have covered relatively large areas, but much can be learned from the survey of small ones as well. One such area is a preserve of The Nature Conservancy located in Johnston County in south-central Oklahoma. Situated on an outcrop of Precambrian granite, it is a 3.2 hectare site that has a number of plant communities; deciduous forest, grasslands, riparian, and granitic outcrop, each with a characteristic assemblage of species. The significance of this site is that exposed

Precambrian granite is relatively infrequent in Oklahoma, composing less than 1 percent of the rock outcrop cover of the state and restricted primarily to a small portion in the south-central part (1). These Precambrian outcrop areas typically have an interesting variety of plants and plant communities (2, 3).

In late 1994 the Oklahoma Chapter of The Conservancy acquired the site via donation by the landowner. In order to determine whether it was biologically significant and worthy of protection in accordance with its goals, The Conservancy required a floristic survey of the vascular plants present. This survey was to be one part of an overall biological assessment of the property. During the

1995 and 1996 growing seasons, such a survey was conducted of both the site and the surrounding area of approximately 6.4 hectares. In addition to documenting the plants present, mapping of the site's different communities and physiographic features using Geographic Information Systems (GIS) techniques was completed. The objectives of this work were: 1) to compile a list of the vascular plant species present, 2) to document the taxa present via herbarium specimens, 3) to compile basic ecological and physiographic data and 4) to produce a site-specific vegetation map using GIS techniques.

### **SITE DESCRIPTION**

The site of the Conservancy's Pennington Creek Nature Sanctuary and surrounding area is approximately 9.6 hectares, located in central Johnston County, (T3S, R6E, Sec.5, SW ¼ SW ¼ and Sec. 6 SE ¼). Located 8.0 km (5 mi) north and 3.2 km (2 mi) west of Tishomingo, it is bordered by Pennington Creek and a graveled county road on the northeast side. The site is located within the Arbuckle Uplift geomorphic province and the Grand Prairie land resources area. The topography consists of gently rolling hills and plains. Ordovician and Cretaceous limestones and Precambrian granites are the parent rock in the area. These granites and rhyolites are the oldest strata in Oklahoma, dating from 1.05 to 1.35 billion years ago, and contribute to this site's uniqueness. They were exposed as sedimentary cover eroded from above them.

Soil types present are the Chigley-Granite outcrop complex with 1 to 8 percent slope and Gracemont soils. The Chigley-Granite outcrop complex consists of a mixture of soils and outcrops of granite. The Chigley soil is a gently sloping, moderately well drained soil on

uplands. Its water table is below a depth of 1 m from February to May and the rate of water intake is moderately slow.

The Gracemont soils are characterized as nearly level to gently sloping, somewhat poorly drained soils in flood plains. Their pattern of soils is intricate; about 35% of an area has a surface layer of loamy fine sand, and 50% has a surface layer of fine sandy loam. These soils are next to the stream channels; the water table is below a depth of 0.1-1.0 m (4-40 in) for most of the year; rate of water intake is rapid.

Precipitation for the area of the site averages about 101.8 cm (40 in) while the average temperature is 16.7 °C (62°F). Of the total annual precipitation, 59% usually falls between the months of April and September. The range of precipitation effectiveness values is from 65 to 50. The growing season for Johnston County ranges from 189 to 230 days. The dominant vegetation type for the area is Post Oak-Blackjack Forest.

### **METHOD OF STUDY**

The major component of this research was the collection and identification of the vascular plants found at the site. During 13 trips from March 1995 to October 1996, vascular plants in fertile condition were collected while the site was systematically traversed on foot. Traditional taxonomic procedures of collecting, pressing, drying, and preservation were employed. Unknown species were identified using the resources of the OSU Herbarium (OKLA). Some plants were identified only to genus because they were not in flower or fruit. Nomenclature was based primarily on that of Waterfall (8) and Gleason and Conquist (9). Common names were taken from Taylor and Taylor (10). Voucher

specimens were deposited in the OSU Herbarium.

The GIS comprised spatial data layers collected in either digital or analog form from a U.S.G.S. aerial photograph, topographic quadrangle map, and the soil survey map of Johnston County. Elevation and soils coverages were digitized from USGS quad map and the soil survey map of Johnston County, respectively. Coverages of plant communities, road, and creek were derived directly from the digitized aerial photograph. Each spatial data layer was accompanied by a table of attribute or non-spatial data. The plant species coverage included attribute data for a representative group of species from each plant community. Each record in the table comprised scientific name, common name, plant community, habit, collection date, collection number and relative abundance. Spatial relationships between distribution of plant species and parameters of plant communities were compared.

### COLLECTION OF SPECIMENS

Field notes were compiled as each plant was collected and included: a description of the plant's habitat, morphology, topography, associated species; the date; collection number, and any additional comments. These notes were made with a microcassette recorder and later transcribed onto individual data collection sheets for each specimen. A small site map in the lower-right corner of each sheet allowed the general position of each plant collected to be recorded.

Specimens were pressed and dried at approximately 43°C for 2-3 days. The specimens were then placed in a freezer at 0°C for a minimum of 1 week. Freezing ensured that all insects and other potential pests were dead before being placed in the herbarium.

Most specimens were identified using *Key of the Vascular Plant Families of Oklahoma* (17) along with U.T. Waterfall's *Keys to the Flora of Oklahoma* (8). Keys in the *Flora of the Great Plains*, Correll and Johnston's *Flora of Texas*, *Gray's Manual of Botany*, and Hampton's treatment of the *Amaranthaceae* (21) were also used to identify plant specimens and herbarium sheets from the OSU herbarium were used to verify identifications. Nomenclature was based primarily on that of Waterfall (8) and Gleason and Cronquist (9).

After the specimens were identified, pressed, and dried they were mounted on herbarium paper. Labels on each specimen provide the scientific name, common name, topography, associated species, collection number, date collected, and relative location of the plant. Each specimen was glued to acid-free herbarium paper with Elmer's Wood Glue®, allowed to dry and then refrozen to kill insects before being accessioned to the OSU herbarium.

### GIS DATA

Multiple layers of data were used for this project which was created using the Arcview 3.0<sup>®</sup> program developed by the Environmental Systems Research Institute (ESRI). The first steps of the project included scanning, registering, and referencing a U.S.G.S. aerial photograph of the preserve. This data layer was assigned real-world coordinates using U.T.M. coordinates. Four derived coverages including property boundaries, road, creek, and plant communities were created on-screen from the digitized aerial photo. The road, creek, and plant community themes were created as polygon coverages and the property boundary, elevation, and soils themes are line coverages. The elevation and soils

coverages were digitized directly from a U.S.G.S. quad map (Reagan series) and the Johnston County Soil Survey, respectively. The plant species coverage was added as points within the boundaries of the plant community coverages.

Most of the attribute data came from the derived coverage plant communities. The soil attribute data supplied important information for each plant community. Along with actual soil types, information regarding their depths and drainage properties was included. The point attribute data of the plant species coverage were added from data collected during the 1995-1996 field research seasons.

Analysis of the data represented within each coverage was done as a point-in-polygon analysis. To gain an

understanding of the relationships between each species's distribution and the physical features of the site, the plant community layers and the soils layer were linked to each taxon.

Ten coverages were generated in the GIS study: they were study area, species, elevation, soils, penncreek, riparian community, granite community, grassland community, forest community, and road. For each coverage two files, shape and text, were created. The shape file depicts coverages as either polygon, line, or point. The text files describe the shape files by means of tabular attribute or aspatial data. For each coverage, an attribute table comprising three to seven fields and one to 100 records was created. The attribute data below allows coverages to be linked or joined via matching fields.

### GIS ATTRIBUTE TABLES

#### Study Area:

<u>Shape</u>	<u>ID#</u>	<u>Boundary Line</u>
Line	1	Study Area Boundary

#### Elevation:

<u>Shape</u>	<u>ID#</u>	<u>Elevation Line</u>
line	1	820 feet
line	2	830 feet
line	3	840 feet
line	4	850 feet

#### Soils:

<u>Shape</u>	<u>ID#</u>	<u>Soil Type</u>	<u>Soil Name</u>	<u>Depth</u>	<u>High Water Table Depth</u>
line	1	6	Chigley Granite Outcrop	0-72 in.	3.0 - 4.0 ft.
line	2	27	Gracemont	0-74 in.	0.5 - 3.0 ft.

#### Riparian Community

<u>Shape</u>	<u>ID#</u>	<u>Community</u>
polygon	1	RP Riparian
polygon	2	RP Riparian

#### Forest Community

<u>Shape</u>	<u>ID#</u>	<u>Community</u>
polygon	1	FO Forest

polygon 2 FO Forest  
Grassland Community

<u>Shape</u>	<u>ID#</u>	<u>Community</u>
polygon	1	GR Grassland
polygon	2	GR Grassland

Granite Community

<u>Shape</u>	<u>ID#</u>	<u>Community</u>
polygon	1	GO Granite outcrop-boulder
polygon	2	GO Granite outcrop-ground level

Road:

<u>Shape</u>	<u>ID#</u>	<u>Road Type</u>
polygon	1	County Road

## RESULTS AND DISCUSSION

Two hundred-three species in 157 genera and 64 families were encountered in this survey (Appendices C-E). The four largest families were the Asteraceae, Poaceae, Fabaceae, and the Cyperaceae (Table 1). These taxa were representative of riparian habitats, post oak-blackjack woods, and prairies.

Table: Number of Genera and Species for the largest Families Present at The Nature Conservancy's Pennington Creek Site.

<u>Family</u>	<u>Genera</u>	<u>Species</u>
Asteraceae	24	32
Poaceae	21	28
Fabaceae	11	14
Cyperaceae	4	10

Species designated by the U.S. Fish and Wildlife Service (11) as endangered, threatened, or Category 1 were not encountered. Although cited as present in the county, *Carex fissa* (S2-imperiled in the state) and *Penstemon oklahomensis* (S3-very rare in the state) were not discovered. The only species presently ranked by the Oklahoma Natural Heritage Inventory (12) as S1, critically

imperiled in the state or S2 was *Alnus maritima*. A species of interest because of its unusual distribution is *Alnus maritima*, seaside alder. It is found only in Johnston and Pontotoc Counties along the Blue River, its tributaries, and Pennington Creek (13). This shrub or small tree comprises large populations on the Delmarva Peninsula of southern Delaware and eastern Maryland. The seaside alder's presence in south-central Oklahoma is unexplained. Documentation of the species' existence in the area dates from 1872 (14). Another riparian plant of interest is *Lobelia cardinalis*. It is an example of a taxon encountered less frequently in its natural setting due to extensive collecting by plant collectors and gardeners.

Present at the preserve are four distinct plant communities: forest, grassland, granitic outcrop, and riparian. The forest community is the largest. It is composed of characteristic crosstimbers taxa. The trees are oak-hickory dominants (15) and include: *Quercus stellata*, *Q. marilandica*, *Carya texana*, *C. cordiformis*, *C. illinoensis*, *Ulmus alata*, and *U. rubra*. Dominant shrubby taxa include *Symphoricarpos orbiculatus* and

*Rhus copallina*. Common herbaceous species present include *Elymus canadensis*, *Geum canadense*, *Antennaria plantaginifolia*, and *Carex caroliniana*.

Small grassland communities are present in openings of the forest community and consist of a mixture of grasses and forbs. Typical species include *Tridens flavus*, *Gaillardia pulchella*, *Sorghastrum nutans*, *Coreopsis tinctoria*, *Castilleja indivisa*, *Setaria lutescens*, and *Bouteloua curtipendula*. The granitic outcrop community is the most unique community of the site. It occurs on the shallow, loose soils surrounding the ground-level granite domes. These shallow soils support species such as *Sedum pulchellum*, *S. nuttallianum*, *Chaetopappa asteroides* and *Krigia virginica*. Many of these species are typical of early successional stages in granite outcrop communities (16). There are also large granite boulders throughout the site, some of which provide habitat on their surfaces or in crevices for taxa such as *Polypodium polypodioides*, *Eragrostis capillaris*, and *Woodsia obtusa*.

The riparian community is characterized by herbaceous species such as *Chasmanthium latifolium*, *Justicia americana*, *Equisetum hyemale*, *Ranunculus hispidus*, and *Lobelia cardinalis*. Woody species present include *Platanus occidentalis* and *Alnus maritima*. Aquatic macrophytes were not observed in the creek.

The GIS permitted comparison of plant distribution and community parameters by creating multiple layers of spatial data and accompanying attribute data. For example, the distribution of *Sedum nuttallianum* and *S. pulchellum* correlated with the occurrence of the Precambrian granite outcrops and the distribution of *Lobelia cardinalis* with the occurrence of riparian habitat.

## ADDENDUM

### *Isoetes butleri* September 14, 1997

On two separate dates (May 15 and 31, 1997, *Isoetes butleri*, Butler's Quillwort, was found on the Nature Conservancy's property at Pennington Creek. This is an important plant species due to its S1 ranking by the Oklahoma Natural Heritage Program. This ranking states that this particular species is critically imperiled in Oklahoma because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because of some factor of its biology making it especially vulnerable to extinction (12).

This perennial aquatic or amphibious plant is found usually from March to June and is most often associated with limestone or calcareous soils (18) but seems to be at home among the granitic outcrops characteristic of central Johnston County. This species was not found or documented before May 1997 due to the extremely dry conditions during the 1996 collecting season. Steady amounts of precipitation during the spring of 1997 helped create conditions required by *Isoetes butleri*. The presence of *Isoetes butleri* warrants some degree of protection for this site.

#### Author's Note:

This site is no longer owned by The Nature Conservancy.

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### Flora of Pennington Creek Preserve

FAMILY	SPECIES	COMMON NAME
<b>Acanthaceae Juss.</b>		<b>Acanthus family</b>
	<i>Justicia Americana</i> (L.) Vahl	
	<i>Ruellia Strepens</i> L.	
<b>Amaranthaceae Juss.</b>		<b>Pigweed family</b>
	<i>Amaranthus rudis</i> Sauer	
<b>Anacardiaceae Lindl.</b>		<b>Cashew family</b>
	<i>Rhus copallina</i> L.	
	<i>Toxicodendron radicans</i>	Poison Ivy
<b>Apiaceae Lindl.</b>		
	<i>Chaerophyllum procumbens</i> L.	
	<i>C. tainturieri</i> Hook.	
	<i>Cicuta maculata</i> L.	
	<i>Limnoscium pinnatum</i> (DC.) Math. & Const.	
	<i>Ptilimnium nuttallii</i> (DC.) Britt.	
	<i>Sanicula canadensis</i> L.	
	<i>Zizia aurea</i> (L.) Koch	
<b>Apocynaceae Juss.</b>		<b>Dogbane family</b>
	<i>Amsonia ciliata</i> Walt.	
<b>Aquifoliaceae Bartl.</b>		<b>Holly family</b>
	<i>Ilex decidua</i> Walt.	
<b>Aristolochiaceae Juss.</b>		<b>Birthwort family</b>
	<i>Aristolochia tomentosa</i> Sims	
<b>Asclepiadaceae R. Br.</b>		<b>Milkweed family</b>
	<i>Asclepias asperula</i> (Dcne.) Woods	
	<i>A. viridis</i> Walt.	
	<i>Matelea</i> sp.	
<b>Aspleniaceae Mett. Ex A.B. Frank</b>		<b>Spleenwort family</b>
	<i>Asplenium platyneuron</i> (L.) D.C. Eat.	
<b>Asteraceae Dum.</b>		<b>Sunflower family</b>
	<i>Achillea millefolium</i> L.	
	<i>Actinomeris alternifolia</i> (L.) DC.	
	<i>Antennaria plantaginifolia</i> (L.) DC.	
	<i>Aster azureus</i> Lindl.	
	<i>A. sagittifolius</i> Willd.	
	<i>Bidens polylepis</i> Blake	
	<i>Chaetopappa asteroides</i> DC.	
	<i>Chrysopsis pilosa</i> Nutt.	
	<i>Coreopsis tinctoria</i> Forma <i>tinctoria</i> Nutt.	
	<i>Elephantopus carolinianus</i> Raeusch.	





*Quercus macrocarpa* Michx.

*Q. marilandica* Muench.

*Q. muehlenbergii* Engelm.

*Q. shumardii* Buckl.

*Q. stellata* Wang.

**Fumariaceae DC. Fumitory family**

*Corydalis micrantha* (Engelm.) Gray

**Gentianaceae Juss. Gentian family**

*Sabatia campestris* Nutt.

**Hydrophyllaceae R. Br.**

*Phacelia strictiflora* (Engelm. & Gray) Gray

**Iridaceae Juss.**

*Sisyrinchium angustifolium* P. Mill.

**Juglandaceae A. Rich. Ex Kunth. Walnut family**

*Carya cordiformis* (Wang.) K. Koch

*C. illinoensis* (Wang.) K. Koch

*C. texana* Buckl.

*Juglans nigra* L.

**Juncaceae Juss. Rush family**

*Juncus marginatus* Rostk.

*Juncus* sp.

**Lamiaceae Lindl. Mint family**

*Hedeoma hispida* Pursh.

*Monarda fistulosa* L.

*Prunella vulgaris* L.

*Satureja arkansana* (Nutt) Briq.

*Scutellaria parvula* Michx.

**Lilaceae Juss. Lily family**

*Allium canadense* L.

*Hypoxis hirsuta* (L.) Coville

*Nothoscordum bivalve* (L.) Britton

*Polygonatum canaliculatum* (Muhl.) Pursh.

**Lythraceae J. St.-Hil. Loosestrife family**

*Lythrum alatum* Pursh

**Malvaceae Juss. Mallow family**

*Callirhoe involucrata* (T. & G.) A.

**Menispermaceae Juss. Moonseed family**

*Cocculus carolinus* (L.) DC.

**Moraceae Link Mulberry family**

*Maclura pomifera* (Raf.) Schneid.

*Morus rubra* L.

**Nyctaginaceae Juss. Four O'clock Family**

*Mirabilis linearis* (Pursh.) Heimerl.

**Oleaceae Hoffmsg. & Link Olive family**

*Fraxinus americana* L.

**Onagraceae Juss. Evening Primrose family**

*Gaura biennis* L. var. *pitcheri* Pickering  
*Ludwigia alternifolia* L.  
*Oenothera linifolia* Nutt.

**Oxalidaceae R. Br. Wood Sorrel family**

*Oxalis corniculata* L.

**Plantaginaceae Juss. Plantain family**

*Plantago purshii* R. & S.  
*P. virginica* L.  
*P. wrightiana* Dcne.

**Plantanaeae Dum. Sycamore family**

*Platanus occidentalis* L.

**Poaceae Barnh. Grass family**

*Agrostis scabra* Willd.  
*Aira elegans* Willd. Ex Gaudin  
*Bothriochloa saccharoides* (Sw.) Rydb.  
*Bouteloua curtipendula* (Michx.) Torr.  
*Bromus japonicus* Thunb. Ex Murr.  
*B. pubescens* Muhl. Ex Willd.  
*B. purgans* L.  
*Chasmanthium latifolium* (Michx.) Yates  
*Cinna arundinacea* L.  
*Echinochloa crus-galli* (L.) Beauv.  
*Elymus virginicus* L.  
*Eragrostis capillaris* (L.) Nees  
*E. spectabilis* (Pursh.) Steud.  
*Festuca arundinacea* Schreb.  
*Lolium multiflorum* Lam.  
*Muhlenbergia sobolifera* (Muhl.) Trin.  
*Panicum acuminatum* Swartz.  
*P. anceps* Michx.  
*P. clandestinum* L.  
*P. laxiflorum* Lam.  
*Paspalum dilatatum* Poir.  
*Setaria lutescens* (Weigel) Hubb.  
*Sorghastrum nutans* (L.) Nash  
*Sorghum halepense* (L.) Pers.  
*Sphenopholis obtusata* (Michx.) Scribn.  
*Sporobolus clandestinus* (Biehler) Hitchc.  
*Tridens flavus* (L.) Hitchc.

**Polemoniaceae Juss. Polemonium family**

*Gilia rubra* (L.) Wherry

**Polygonaceae Juss. Buckwheat family**

*Polygonum punctatum* Ell.  
*Rumex hastatulus* Baldw.

**Polypodiaceae S. F. Gray True Fern family**

- Polypodium polypodioides* (L.) Watt  
**Primulaceae Vent. Primrose family**  
*Samolus parviflorus* Raf.
- Ranunculaceae Juss. Buttercup family**  
*Delphinium tricornis* Michx.  
*Ranunculus* sp.  
*Ranunculus fascicularis* Muhl.  
*R. hispidus* Michx.
- Rhamnaceae Juss. Buckthorn family**  
*Berberis scandens* (Hill) K. Koch  
*Rhamnus caroliniana* Walt.
- Rosaceae Juss. Rose family**  
*Geum canadense* Jacq. var. *camporum* (Rydb.) Fern.  
*Prunus mexicana* S. Wats.  
*Rosa setigera* var. *setigera* Michx.  
*Rubus* sp.
- Rubiaceae Juss. Madder family**  
*Cephalanthus occidentalis* L.  
*Diodia teres* Walt.  
*Galium aparine* L.  
*G. pilosum* Ait.  
*Hedyotis crassifolia* Raf.
- Rutaceae Juss. Citrus family**  
*Zanthoxylum americanum* Mill.
- Sapotaceae Juss. Sapodilla family**  
*Bumelia lanuginosa* (Michx.) Pers.
- Scrophulariaceae Figwort family**  
*Castilleja indivisa* Engelm.  
*Collinsia violacea* Nutt.  
*Linaria canadensis* (L.) Dumont]
- Smilacaceae Vent. Greenbrier family**  
*Smilax bona-nox* L.
- Ulmaceae Mirb. Elm family**  
*Ulmus alata* Michx.  
*U. rubra* Muhl.
- Valerianaceae Batsch Valerian family**  
*Valerianella radiata* (L.) Dufr.
- Verbenaceae St.-Hil. Vervain family**  
*Phryma leptostachya* L.  
*Verbena urticifolia* L.
- Violaceae Batsch Violet family**  
*Viola langloisii* Greene  
*V. rafinesquii* Greene  
*V. sororia* Willd.
- Vitaceae Juss. Grape family**  
*Vitis acerifolia* Raf.