

Monitoring Vascular Plants of Federal Concern: *Asclepasis uncialis* Greene and *Trillium pusillum* Michx.  
var. *ozarkanum* (Palmer & Steyermark) Steyermark  
E-61-1

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## Table of Contents

### Part 1: *Asclepias uncialis* Greene

I. Purpose	1
A. Narrative	1
B. Goals	1
C. Objectives	1
II. Species Information	1
A. Nomenclature	1
1. Scientific Name	1
2. Common Name	1
3. Valid Synonyms	1
4. Classification	2
5. Bibliographic Citation	2
6. Type Specimen	2
7. USDA Code	2
8. History of Knowledge	2
9. Alternative Taxonomic Treatment	3
B. Legal or Conservation Status	3
1. Federal	3
2. State	3
3. Global and Sub-national Rankings	4
C. Morphology	4
D. Life History	5
E. Related Species	6
F. Geographical Distribution	6
G. Historic Sites	7
H. Current Sites	8
III. Study Site	9
A. General Location	9
IV. Field Work	9
A. Sample Sites and Study Areas	9
B. Surveyors and Observers	10
C. Time/Duration/Frequency	10
D. Methods	10
E. Data Analysis	11
V. Results	11
A. Sites Not Sampled and Objectives Not Met	11
B. Sites Successfully Sampled	11
C. Photographs	12
D. Data Forms	12
VI. Discussion	12
A. Interpretation/assessment	12
B. Successfulness	12
C. Next Steps	12
VII. Literature Cited	12
IIIX. Appendices	14
A. Completed Data Sheets	14
B. Data Results Spreadsheet	14
C. Other Materials	15

## Part 2: *Trillium pusillum* Michx. var. *ozkarkanum* (Palmer and Steyermark) Steyermark

I. Purpose	16
A. Narrative	16
B. Goals	16
C. Objectives	16
II. Species Information	16
A. Nomenclature	16
1. Scientific Name	16
2. Common Name	16
3. Valid Synonyms	16
4. Classification	17
5. Bibliographic Citation	17
6. Type Specimen	17
7. USDA Code	17
8. History of Knowledge	17
9. Alternative Taxonomic Treatment	17
B. Legal or Conservation Status	18
1. Federal	18
2. State	18
3. Global and Sub-national Rankings	18
C. Morphology	19
D. Life History	19
E. Related Species	20
F. Geographical Distribution	20
G. Historic Sites	21
H. Current Sites	22
III. Study Site	22
A. General Location	22
IV. Field Work	23
A. Sample Sites and Study Areas	23
B. Surveyors and Observers	24
C. Time/Duration/Frequency	24
D. Methods	24
E. Data Analysis	24
V. Results	25
A. Sites Not Sampled and Objectives Not Met	26
B. Sites Successfully Sampled	26
C. Photographs	26
D. Data Forms	26
VI. Discussion	30
A. Interpretation/assessment	30
B. Successfulness	30
C. Next Steps	30
VII. Literature Cited	30
IIIX. Appendices	33
A. Completed Data Sheets	33
B. Data Results Spreadsheet	33
C. Other Materials	33





## Part 1: *Asclepias uncialis* Greene

### I. Purpose

#### A. Narrative

*Asclepias uncialis* Greene is a vascular plant of federal concern in the state of Oklahoma. Formerly listed as a Category 2 species, *A. uncialis* has not previously been examined or monitored within the state. Extensively collected throughout its range during the nineteenth century, McGregor's *Flora of the Great Plains* describes the species currently as "rare or overlooked" (Great Plains Flora Association 1986). The causes of the decline in reports of this species are unknown. Surveys for populations of this plant were conducted to determine its current extent in the state of Oklahoma. Historical collection sites were visited, as well as sites with similar habitats that could support populations of the species.

#### B. Goals

We wished to determine the status of *Asclepias uncialis* at historic sites and also to survey similar habitats for new populations. We wished to measure habitat parameters including soil depth and type, canopy cover, and associated species.

#### C. Objectives

Historic populations were to be surveyed utilizing 1.0 m<sup>2</sup> plots. Habitat parameters were also to be measured. These parameters were to include canopy cover, soil depth and type, and associated species. If new populations were located, these survey techniques were also to be utilized. Locations of all populations were to be recorded with a GPS unit.

### II. Species Information

#### A. Nomenclature

##### 1. Scientific Name

*Asclepias uncialis* Greene

##### 2. Common Name

Wheel milkweed, Greene milkweed, and dwarf milkweed are some of the common names for this plant (Oklahoma Natural Heritage Inventory 1999, Arizona Game and Fish Department 2006, United States Geological Service 2006)

##### 3. Valid Synonyms

*Asclepias uncialis* has no valid synonyms (USDA 2006).

#### 4. Classification

According to the USDA, *Asclepias uncialis* is classified as follows (USDA 2006):

Kingdom Plantae – plants  
Subkingdom Tracheobionta – vascular plants  
Superdivision Spermatophyta – seed plants  
Division Magnoliophyta – flowering plants  
Class Magnoliopsida – dicotyledons  
Subclass Asteridae  
Order Gentianales  
Family Asclepiadaceae – milkweed family  
Genus *Asclepias* L. – milkweed  
Species *Asclepias uncialis* Greene – wheel milkweed

In his 1954 monograph of the genus *Asclepias*, Woodson placed *A. uncialis* in subgenus *Asclepiodella* (Small) Woodson (Woodson 1954).

#### 5. Bibliographic Citation

*Asclepias uncialis* was first published by Edward Lee Greene in the *Botanical Gazette* (Crawfordsville, Indiana), volume 1880, page 64.

#### 6. Type Specimen

Greene did not select a type specimen, although the material he described was from Silver City, New Mexico. A collection by E. L. Greene, dated 27 April 1880, with the location of “open hill-tops in southwestern New Mexico about Silver City” is located at the New York Botanical Garden (New York Botanical Garden 2006). R. E. Woodson Jr. formerly typified the name in his monograph of the genus *Asclepias* in the 1954 *Annals of the Missouri Botanical Garden*. This lectotype (E. L. Greene s. n., 25 Apr 1880) is at the Missouri Botanical Garden (Woodson 1954, Arizona Fish and Game Department 2006). Isotypes can be found at the herbaria of the Academy of Natural Sciences, the Field Museum, and the New York Botanical Garden (Decker, 2006).

#### 7. USDA Code

The code used by the United States Department of Agriculture for *Asclepias uncialis* is ASUN4 (USDA 2006).

#### 8. History of Knowledge

*Asclepias uncialis* was first described by E. L. Greene in 1880, although he did not formerly typify the species. Earlier collections of the plant exist from New Mexico, Colorado, and Wyoming, but were originally only identified to genus or identified as a similar species, *A.*

*brachystephana* (Decker 2006). R. E. Woodson formerly selected a type in his monograph of the genus *Asclepias* in 1954.

## 9. Alternative Taxonomic Treatment

In the past, taxonomic confusion surrounded *Asclepias uncialis*. Early collections of *A. uncialis* were frequently denoted as *A. brachystephana* (Decker 2006). Woodson described the species, along with *A. ruthiae* and *A. cutleri*, as “an odd little constellation of satellites about *A. brachystephana*; all greatly reduced in size and scattered in their arid distributions” (Woodson 1954). Sundell placed *A. sanjuanensis* and *A. ruthiae* into *A. uncialis* var. *ruthiaea*, treating *A. uncialis* specimens as *A. uncialis* var. *uncialis* (Sundell 1990). The USDA currently recognizes two subspecies of *A. uncialis*; *A. uncialis* Greene ssp. *uncialis* and *A. uncialis* Greene ssp. *ruthiae* (Maguire) Kartesz & Gandhi (USDA 2006). The subspecies *ruthiae* includes *A. eastwoodiana*, *A. ruthiae*, and *A. sanjuanensis*, often considered full species by other authors (Woodson 1954, Cronquist et al. 1984). Genetic work may also indicate that these are distinct species (Therrien 1999, Arizona Game and Fish Department 2006, Decker 2006). *A. uncialis* ssp. *ruthiae* (or, consequently, the species *A. eastwoodiana*, *A. ruthiae*, and *A. sanjuanensis*) is not found in Oklahoma. *Asclepias uncialis* ssp. *uncialis* is considered equivalent to *A. uncialis sensu stricto*, excluding *A. eastwoodiana*, *A. ruthiaea*, and *A. sanjuanensis* (Decker 2006, NatureServe 2006). This report will refer to *Asclepias uncialis* in *sensu stricto* hereafter.

## B. Legal or Conservation Status

### 1. Federal

Currently *Asclepias uncialis* has no federal conservation status under the Endangered Species Act (United States Department of the Interior 2005). Prior to 1996, it was listed as a Category 2 species, or “a likely candidate for federal listing as endangered or threatened, but it is necessary to obtain further information regarding possible threats” (United States Department of the Interior 1993). *Asclepias uncialis* is treated as a sensitive species in United States Forest Service Region 2, which includes the Colorado and Wyoming populations, and in Region 3, which includes the Arizona, New Mexico, and Oklahoma populations (Arizona Game and Fish Department 2006, Decker 2006).

### 2. State

*Asclepias uncialis* has no official conservation status in the states of Arizona, Colorado, Nevada, Oklahoma, and Utah (Utah Division of Wildlife Resources 1998, Oklahoma Natural Heritage Inventory 2003, Arizona Game and Fish Department 2006, Colorado Natural Heritage Program 2006, Nevada Natural Heritage Program 2006). The species has a “dropped” status in New Mexico, indicating that it is no longer considered to be threatened or endangered (Natural Heritage New Mexico 2006). The plant is listed as “of

concern” in Wyoming, indicating that it is “vulnerable to extirpation due to rarity, inherent vulnerability, and/or threats” (Wyoming Natural Diversity Database 2006).

### 3. Global and Sub-national Rankings

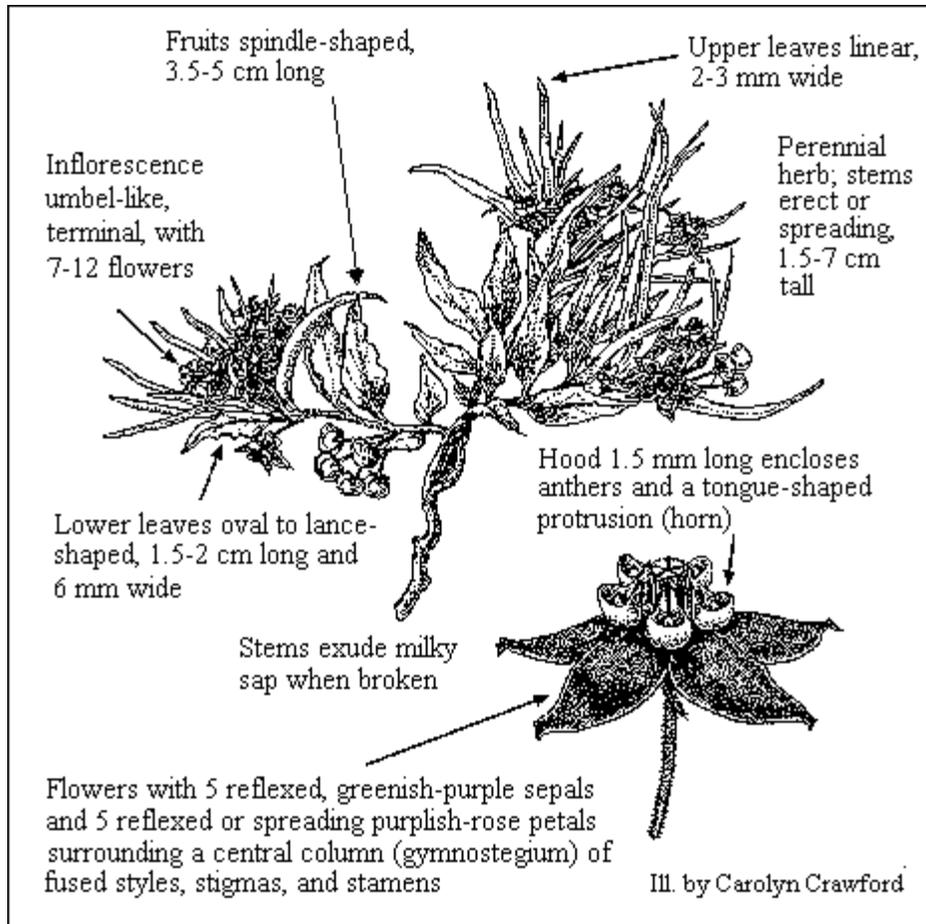
*Asclepias uncialis* is listed as a G3G4 species, with a rounded ranking of G3, indicating it is “vulnerable or at moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors” (NatureServe 2006).

Arizona ranks the plant as an S1?, indicating that it is critically imperiled “because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state” (NatureServe2006). The question mark attached to the ranking indicates that more work needs to be done in the state to determine a precise ranking. Colorado ranks the plant as an S2, indicating that it is “imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state” (NatureServe 2006). New Mexico ranks *Asclepias uncialis* as S2S3, indicating that its status is imperiled to vulnerable (NatureServe 2006). In Wyoming, the plant is an SH, indicating that it has possibly been extirpated from the state (NatureServe 2006). Nevada and Utah do not rank *A. uncialis* (Utah Division of Wildlife Resources 1998, Nevada Natural Heritage Program 2006). Oklahoma ranks the plant as an S1 (Oklahoma Natural Heritage Inventory 2003).

### C. Morphology

*Asclepias uncialis* is a small herb. Multiple, slightly hairy stems 1.5 to 7.0 cm in length ascend or descend from a vertical rootstock. The stems exude a white latex when damaged. Leaves are heterophyllous, with the upper narrowly lanceolate and 2.0 to 3.0 mm wide and the lower oval to ovate and up to 6.0 mm in width. All leaves are sessile to short-petioled, slightly glaucous, and may have white tomentose margins. The leaves are alternate, but may appear to be opposite. The inflorescence of *Asclepias uncialis* is a sessile, usually terminal, umbel with three to 12 flowers on thin pedicels. There is usually only one inflorescence per plant.

Flowers of *Asclepias uncialis* are 4.5 to 5.0 mm in length, with five fused, slightly hairy, reflexed, greenish-purple sepals. There are five dullish rose-purple, fused, hairless petals. Hoods are shorter than the anther, usually around 1.5 mm, and have short and thick tongue-shaped horns. A central column, or gynostegium, composed of fused stamens, stigmas and styles is present. The pollen of the milkweed is aggregated into a waxy structure called a pollinium, which is approximately 0.5 mm in length. The plant produces a spindle-shaped fruiting follicle 3.5 to 5.0 cm in length. The follicle contains numerous seeds edged in white hairs (Green 1880, Woodson 1954, Great Plains Flora Association 1986, Oklahoma Natural Heritage Inventory 1999, United States Geological Service 2006, Wyoming Natural Diversity Database 2006).



*Asclepias uncialis* (United States Geological Service 2006)

#### D. Life History

*Asclepias uncialis* is a long-lived perennial herb. The plant is typically found in sandy or rocky semi-arid shortgrass prairies on plains, open hills, or low slopes. The plant has also been found scattered in pinyon-juniper woodlands. Most often, the milkweed is found on bare soil between patches of vegetation, or even in areas with noticeable disturbance.

Associated species include *Bouteloua gracilis*, *B. curtipendula*, *B. hirsuta*, *Buchloe dactyloides*, *Gutierrezia sarothrae*, *Tetaneuris scaposa*, *Chaetopappa ericoides*, *Melampodium leucanthum*, *Polygala alba*, and *Yucca glauca*. It has been reported growing at elevations from 1,200 to 1,900 m. *Asclepias uncialis* has not been associated with a particular soil type, but has been found on Travesill sandy loam, sandy loam from red sandstone and interbedded shale, channery loams from interbedded limestone and shale, and on clay.

According to McGregor, *Asclepias uncialis* is the earliest blooming milkweed in the Great Plains, beginning to flower from late March. Flowering may persist up until late June, with fruit set from late May to late June. The stems of the plant may persist until the fall.

*Asclepias uncialis* may have a dormant phase in which the root system is alive, but does not produce any above-ground growth for many years.

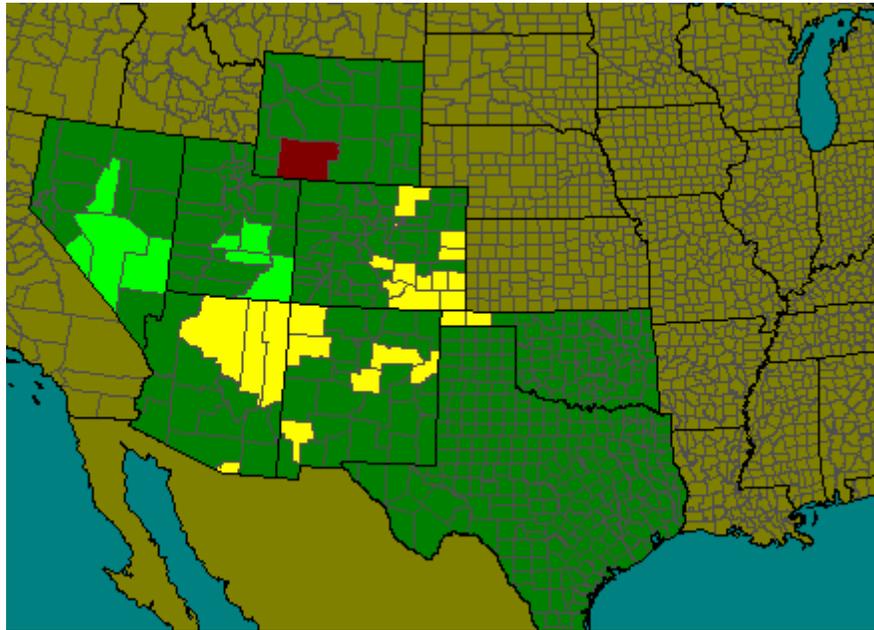
*Asclepias uncialis* is most likely self-incompatible. Flowers produce a strong, sweet odor, and are insect-pollinated. The specific pollinators are unknown. Following pollination, seeds mature quickly, possibly as an adaptation to avoid summer drought. Fruit set is low. The haired seeds are dispersed by the wind. Germination requirements for the plant are currently unknown. Overall rates of successful sexual reproduction are low. Some vegetative reproduction may occur from fragmentation of the underground stems (Woodson 1954, Great Plains Flora Association 1989, Oklahoma Natural Heritage Inventory 1999, Arizona Game and Fish Department, 2006, Decker 2006, Wyoming Natural Diversity Database 2006).

#### E. Related Species

*Asclepias uncialis* may appear similar to *A. pumila*, although *A. pumila* does not exhibit heterophylly and has white flowers. The blooming period of *A. pumila* is also later. *A. involucrata* is another similar species, but may be distinguished from *A. uncialis* by its lack of heterophylly, hoods that are longer than the anthers, and a later blooming period. Leaf size and shape in *A. subverticillata* and *A. verticillata* are similar to wheel milkweed, but these species possess peduncled rather than sessile inflorescences (Oklahoma Natural Heritage Inventory 1999, Arizona Game and Fish Department 2006, United States Geological Service 2006).

#### F. Geographic Distribution

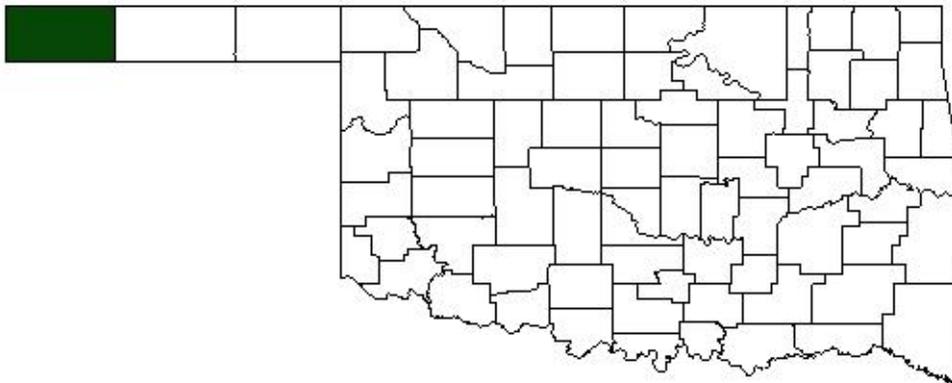
Populations of *Asclepias uncialis* have been noted from the states of Arizona, Colorado, New Mexico, Oklahoma, Utah, and Wyoming.



Distribution of *Asclepias uncialis* in the United States (Kartesz and Meacham 2004).

In the map above, dark green indicates the possible historical range of *Asclepias uncialis*. Red indicates populations that have probably been extirpated; bright green indicates the presence of known populations; yellow indicates known but rare populations (Kartesz and Meacham 2004).

In Oklahoma, the plant is only definitely known from one location in Cimarron County.

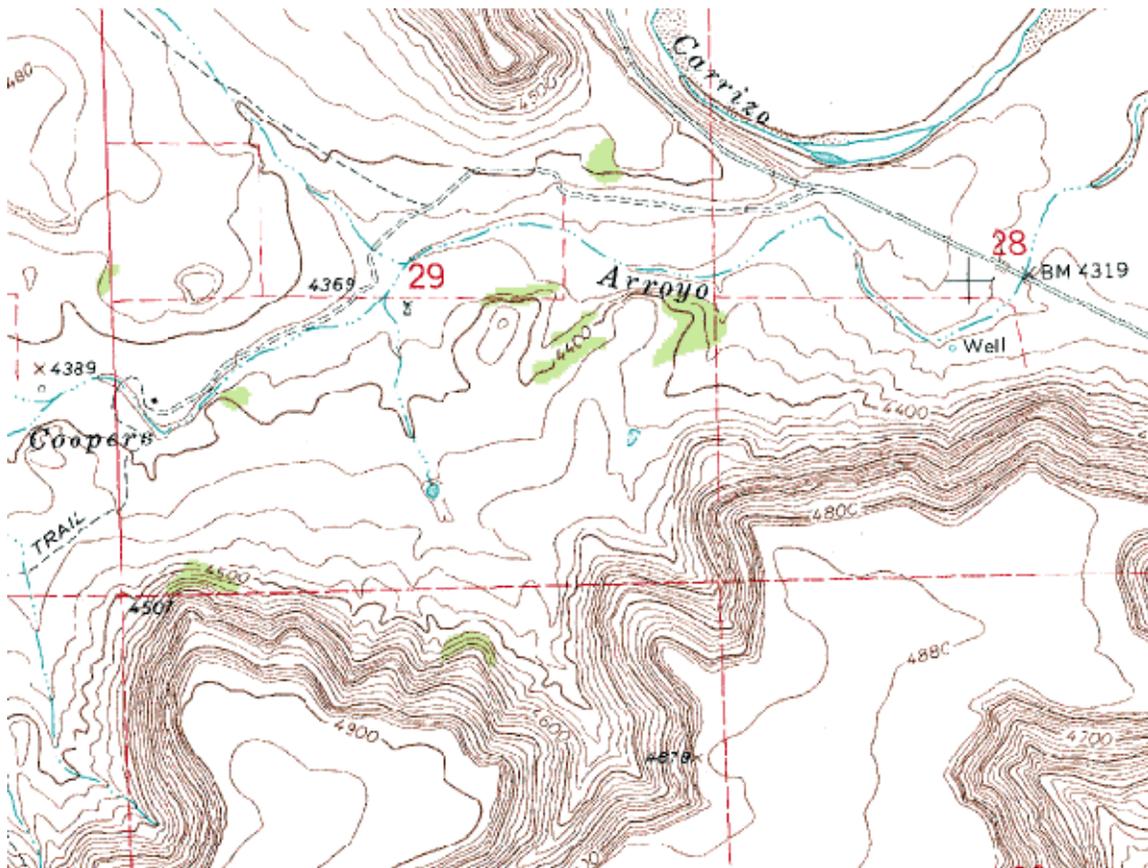


Distribution of *Asclepias uncialis* in Oklahoma (Hoagland et al. 2006)

#### G. Historic Sites

There are two historic Oklahoma sites for *Asclepias uncialis* mentioned in the literature. The first is known from a herbarium specimen at Oklahoma State University (Hoagland et al. 2006):

Accession number 135992, collected by J. K. McPherson, April 25, 1993. From Cimarron County, OK, from Kenton, OK, around 0.5 miles east and 4.0 miles northwest, at The Nature Conservancy/State Parks Black Mesa Preserve, T6N R1E Section 29 (latitude/longitude not noted).



Topographic map of the general location of the McPherson collection (TopoZone 2006)

A reference to *A. uncialis* in Texas County, Oklahoma is found in *Flora of Great Plains* and in an online listing of the flora of Texas County, Oklahoma. The specimen this citation is based upon could not be located, and an exact location for the plant within Texas County could not be determined (Great Plains Flora Association 1989, Schaefer 2005). Please see the included CD for location data in spreadsheet form.

#### H. Current Sites

No current populations of *Asclepias uncialis* were located.

### III. Study Site

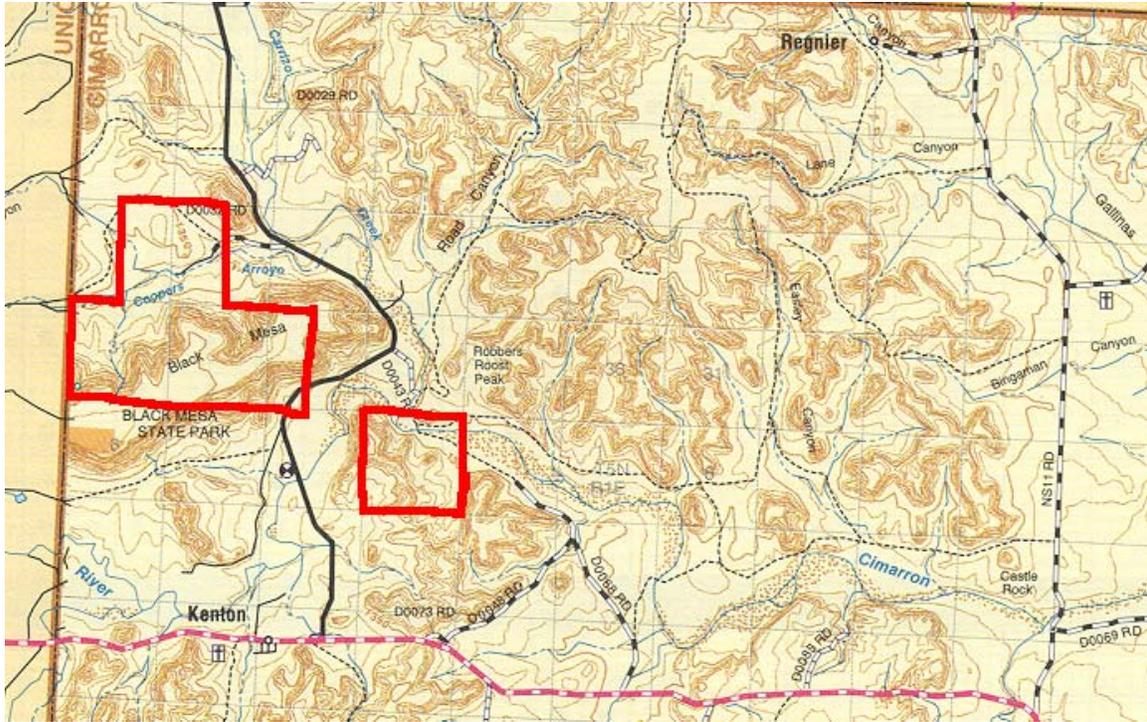
#### A. General Information

Field work for this project took place in Cimarron County, Oklahoma, just north of Kenton, Oklahoma at The Nature Conservancy/Oklahoma State Parks Black Mesa Preserve. The areas surveyed included shortgrass prairie and *Juniperus monosperma* woodland habitats. Soil types encountered included Apache stony clay loam, Berthoud loam, Rough stony land, and Travesilla stony loam. Species encountered included *Aristida* spp., *Buchloe dactyloides*, *Bouteloua curtipendua*, *B. gracilis*, *B. hirsuta*, *Chaetopappa ericoides*, *Comandra pallida*, *Dalea formosa*, *Echinocereus viridis*, *Melampodium leucanthemum*, *Opuntia imbricata*, *O. polyacantha*, *O. phaeacantha*, *Tetrateuris scaposa*, and *Yucca glauca*. These habitats, soils, and species are all known to be associated with populations of *Asclepias uncialis*.

### IV. Field Work

#### A. Sample Sites and Study Areas

Areas around The Nature Conservancy/Oklahoma State Parks Black Mesa Preserve were selected to survey for populations of *Asclepias uncialis*. This area included the historic McPherson collection site. All areas searched were similar to areas where *A. uncialis* had been found previously (in Oklahoma and in other states) in terms of habitat types, soil types, and associated species. The following areas were extensively searched by foot for populations of the plant: T6N, R1E, western half of section 29, T6N, R1E, eastern half of section 30, T6N R1E, sections 31 and 32, T6N R1E, western half of section 33, and T5N, R1E, section 3. These areas correspond to approximately 6° 57.53'N, 102° 58.42'W (WGS84/NAD83).



Areas surveyed for *Asclepias uncialis* (in red).

#### B. Surveyors and Observers

Areas were surveyed by Amy K. Buthod and Bruce W. Hoagland of the Oklahoma Natural Heritage Inventory. Observers included University of Oklahoma students Lacy Brookshire, Lacy Jo Burgess, and Shannon Hall.

#### C. Time/Duration/Frequency

Times in late May through mid-June were selected to ensure that the plants were in bloom or in fruit. Surveys for *Asclepias uncialis* were made May 31, 2005, June 1, 2005, and May 17, 2006. The work on May 31, 2005 was concentrated in the area of the historic McPherson collection (T6N R1E section 29). Bruce Hoagland walked through suitable habitats for over five hours. No plants were located. On June 1, 2005, Bruce Hoagland walked the area around T5N R1E section 33 for approximately three hours. No plants were located. On June 17, 2006, Bruce Hoagland and Amy Buthod extensively searched shortgrass prairie habitats of areas around T6N R1E sections 30, 31, 32, and 33 for over eight hours. No plants were found.

#### D. Methods

Survey sites were selected primarily based on herbarium specimen records. *The Oklahoma Vascular Plants Database* was consulted to locate herbarium specimens of *Asclepias uncialis* (Hoagland et al. 2006). Information from the herbarium specimen label, including location, habitat type, and soil type led us to select areas around the Black Mesa Preserve. A soil

survey of Cimarron County was consulted to locate areas of Berthoud loam, which was the type of soil cited on the label of the one herbarium collection. Surveys for the plant were done in a random fashion. Suitable habitats were slowly walked and scanned for any signs of the plants. Without the exact coordinates of any historic collections, this was the only way the survey could be conducted.

After over 16 hours of hiking the area, no plants were found on any of the three days. If plants had been found, the following methodology would have been followed. All plants found would have a 1.0 m<sup>2</sup> PVC plot placed around them. Since this is a rare plant, we assumed that there would be few individuals, allowing us to collect data from multiple plots including all individuals. The northeastern corner of the plot would be marked using a GPS unit to record UTM coordinates. Densimeter readings would be taken from the four corners and the center of the plot. These would have been averaged to get the percentage canopy cover of the plot. A measurement of the depth of the soil would be taken at the northeastern corner of a plot, using a marker in centimeters. Soil samples would have been taken at each of the four corners of the plot as well as the center. These samples would be mixed together and sent to the soil lab for testing of pH, percentage of organic matter, and N, P, and K levels. The community type would be noted. Types of associated species would be recorded and their percentage of cover within the plot would have been estimated. Woody species, if present, would have their diameter at breast height (DBH) recorded in centimeters. The total number of *Asclepias uncialis* individuals present in the plot would be noted. The total number of stems, number of stems in flower, number of stems in fruit, number of immature stems, and number senescent stems would all be recorded. Notes regarding overall population vigor and evidence of disease or herbivory would be noted. A drawing of the plot would be prepared.

#### E. Data Analysis

No plants of *Asclepias uncialis* were located, although suitable habitat was found.

### V. Results

#### A. Sites Not Sampled and Objectives Not Met

Despite extensive surveying efforts, no populations of *Asclepias uncialis* were located around the one known historic collection site in Oklahoma. No location data was available for the Texas County specimen, so this area was not sampled. None of our “objectives” could be met.

#### B. Sites Successfully Sampled

No populations of *Asclepias uncialis* were located during the course of this study. Therefore, no sites were successfully sampled.

### C. Photographs

No photos are available, as no plants were located.

### D. Data Forms

No data forms are available, as no plants were located during the study.

## VI. Discussion

### A. Interpretation/Assessment

No data was collected during this survey because no plants were found. However, as mentioned in the “life history” section of this report, the plant may have a dormant phase in which the roots system is alive but does not produce above-ground growth for many years, and the habitat encountered in the Black Mesa area was suitable. Therefore, future surveys should probably be conducted in this area.

Possible threats to *Asclepias uncialis* include habitat loss and encroachment of exotic species such as *Bromus tectorum*, although the extent of these threats is unknown due to a limited knowledge of the plant’s life history. Populations are small and isolated, resulting in limited gene flow. This may contribute to declines in viability. Other concerns include inbreeding depression, changing grazing regimes, fire suppression, and the loss of pollinators (Decker 2006).

### B. Successfulness

We did not locate any populations of *Asclepias uncialis*. However, the habitats we encountered were suitable for the plant. Future surveys for the plant should occur in the Black Mesa area.

### C. Next Steps

More surveys for this plant should be conducted in the future. Since it may have a dormant phase where no above-ground growth is produced for many years, a multi-year survey may be necessary. The Black Mesa area provides suitable habitat and should be searched again in the coming years. More attempts to locate the site of the Texas County collection should also be made, and attempts to find additional suitable habitat should be conducted. If populations of *Asclepias uncialis* are located in the future, their habitat parameters should be assessed in a manner similar to what is described in the “methods” portion of this paper.

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Woodson Jr., R. E. 1954. The North American species of *Asclepias* L. *Annals of the Missouri Botanical Garden* 41: 1-211.

Wyoming Natural Diversity Database. 2006. Plant species of concern. Available online at: [http://uwadmnweb.uwyo.edu/wyndd/Plants/plant\\_soc\\_list.htm](http://uwadmnweb.uwyo.edu/wyndd/Plants/plant_soc_list.htm).

## IIX. Appendices

### A. Completed Data Sheets

There are no completed data sheets, as no plants of *Asclepias uncialis* were found.

### B. Data Results Spreadsheet

There is no data results spreadsheet, as no plants of *Asclepias uncialis* were found.

#### C. Other Materials

There are no other materials associated with this project.

## Part 1: *Trillium pusillum* Michx. var. *ozarkanum* (Palmer & Steyermark) Steyermark

### I. Purpose

#### A. Narrative

*Trillium pusillum* Michx. var. *ozarkanum* (Palmer & Steyermark) Steyermark is a vascular plant of federal concern in the state of Oklahoma. Formerly listed as a Category 2 species, *Trillium pusillum* var. *ozarkanum* is known from only one site in LeFlore County. Surveys for populations of this plant were conducted to determine its current extent in the state of Oklahoma, as well as its habitat parameters. The historical collection site was visited, as were sites with similar habitats that could possibly support populations of the species.

#### B. Goals

We wished to determine the status of *Trillium pusillum* var. *ozarkanum* at its historic site and to also survey similar habitats for new populations. We wished to measure habitat parameters including soil depth and type, canopy cover, and associated species.

#### C. Objectives

Historic populations were surveyed utilizing 1.0 m<sup>2</sup> plots. Habitat parameters were also measured. These parameters included canopy cover, soil depth and type, and associated species. Surveys for new populations were conducted in several areas with similar habitats. The location of the extant population was recorded with a GPS unit.

### II. Species Information

#### A. Nomenclature

##### 1. Scientific Name

*Trillium pusillum* Michx. var. *ozarkanum* (Palmer & Steyermark) Steyermark

##### 2. Common Name

Dwarf trillium, least trillium, Ozark wake-robin, and Ozark least trillium are all common names of *Trillium pusillum* var. *ozarkanum* (Oklahoma Natural Heritage Inventory 1999, Flora of North American Committee 2002, Kentucky State Nature Preserves Commission 2006, NatureServe 2006).

##### 3. Valid Synonyms

According to the USDA, *Trillium ozarkanum* Palmer & Steyermark is a valid synonym for *Trillium pusillum* var. *ozarkanum* (USDA 2006).

#### 4. Classification

According to the USDA, *Trillium pusillum* var. *ozarkanum* is classified as follows (USDA 2006):

Kingdom Plantae – plants

Subkingdom Tracheobionta – vascular plants

Superdivision Spermatophyta – seed plants

Division Magnoliophyta – flowering plants

Class Liliopsida – monocotyledons

Subclass Liliidae

Order Liliales

Family Liliaceae – lily family

Genus *Trillium* L. – trillium

Species *Trillium pusillum* Michx. – dwarf wakerobin

Variety *Trillium pusillum* Michx. var. *ozarkanum* (Palmer & Steyermark) Steyermark – Ozark wakerobin

#### 5. Bibliographic Citation

*Trillium pusillum* var. *ozarkanum* was described in 1960 in *Rhodora* volume 62, page 130.

#### 6. Type Specimen

The type specimen for *Trillium pusillum* var. *ozarkanum* is located at the Missouri Botanical Garden. It was collected by J. A. Steyermark (collection number 18628) in Missouri on April 20, 1935 “in cherty soils along slopes of a draw in upland oak-chinquapin woods, 3.0 mi south of Cassville, Barry Co.” (Palmer and Steyermark 1935).

#### 7. USDA Code

The USDA code for *Trillium pusillum* var. *ozarkanum* is TRPUO (USDA 2006).

#### 8. History of Knowledge

*Trillium pusillum* var. *ozarkanum* was originally treated as the full species *T. ozarkanum* Palmer and Steyermark in a 1935 *Annals of the Missouri Botanical Garden*. Steyermark reduced it to varietal status in 1960 in *Rhodora* (Steyermark 1960).

#### 9. Alternative Taxonomic Treatment

In the Flora of North American, *Trillium pusillum* var. *ozarkanum* is currently included within the broadly circumscribed *Trillium pusillum* Michx. var. *pusillum* based on the lack of morphological variations among it and other varieties (Flora of North American Committee 2002). Some authors place the genus *Trillium* in the family Trilliaceae (International Plant Names Index 2005).

## B. Legal or Conservation Status

### 1. Federal

Currently, *Trillium pusillum* var. *ozarkanum* has no federal conservation status under the Endangered Species Act (United States Department of the Interior 2005). Prior to 1996, it was listed as a Category 2 species, or “a likely candidate for federal listing as endangered or threatened, but it is necessary to obtain further information regarding possible threats” (United States Department of the Interior 1993).

### 2. State

*Trillium pusillum* var. *ozarkanum* has no status in the states of Missouri and Oklahoma (Oklahoma Natural Heritage Inventory 2003, Missouri Department of Conservation 2006). In Arkansas it is considered to be an “inventory element”, or a species that “the Arkansas Natural Heritage Commission is currently conducting active inventory work on” and that “available data suggests” is of “conservation concern” (Arkansas Natural Heritage Commission 2006). Kentucky lists the plant as “endangered” or “in danger of extirpation and/or extinction throughout all or a significant part of its range in Kentucky” (Kentucky State Nature Preserves Commission 2006). In Tennessee it is also considered endangered or to be a “plant whose continued existence as a viable component of the state’s flora is determined...to be in jeopardy” (Tennessee Natural Heritage Program 2004).

### 3. Global and Sub-national Rankings

*Trillium pusillum* var. *ozarkanum* is listed as a G3T3 species, with a rounded global status of T3, indicating that it is “either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range, or because of other factors making it vulnerable to extinction throughout its range” (Oklahoma Biological Survey 2001, NatureServe 2006). The “T” indicates that this is a global rank associated with a subspecific taxon (Oklahoma Biological Survey 2001).

In Arkansas, the sub-national rank of *Trillium pusillum* var. *ozarkanum* is S3, indicating that it is “vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation” (NatureServe 2006). Missouri ranks the plant as an S2, or “imperiled in state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state”

(NatureServe 2006). Oklahoma, Kentucky, and Tennessee rank the plant as an S1, indicating that it is “critically imperiled in the states because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province” (NatureServe 2006).

### C. Morphology

*Trillium pusillum* var. *ozarkanum* grows from a long, thick rhizome. The stems are 10.0 to 30.0 cm tall, fleshy, glabrous, and purple in color at their bases. Leaves are deep, dull green above and shiny below. They are lanceolate or oblong-elliptic to oblong-ovate in shape and 3.5 to 8.5 cm long. The leaves are subsessile and surround the stem in a whorl. The plant has an erect peduncle, which is 1.5 to 3.0 cm in length, with a single flower at its terminus. There are three green spreading sepals, usually with 5 prominent linear veins. They are linear-oblong to oblong-ovate in shape and 1.5 to 4.0 cm long. The three petals are white to pink to purple, changing in color with maturation. They are oblong-lanceolate to ovate in shape, and 1.6 to 3.4 cm long. The six stamens slightly exceed the stigmas, which are untied at base. There is a single pistil with a three-angled ovary. The plants produce a green berry 0.8 to 1.0 cm long. The seeds are numerous, dark brown and shiny (Palmer and Steyermark 1935, Oklahoma Natural Heritage Inventory 1999, Yatskievych 1999, Missouri Department of Conservation 2004).

### D. Life History

*Trillium pusillum* var. *ozarkanum* is typically found on thin, cherty, acidic soils of oak-hickory or hardwood-pine forests. Although it is typically found on slopes, a particular slope aspect is not preferred. Canopy associates may include *Quercus alba*, *Q. rubra*, *Q. velutina*, *Carya texana*, *C. tomentosa*, *Pinus echinata*, *Prunus serotina*, *Nyssa sylvatica*, and *Acer saccharum*. Sub-canopy and herbaceous associates may include *Rhamnus caroliniana*, *Amelanchier arborea*, *Vaccinium* spp., *Antennaria plantaginifolia*, *Carex meadii*, *Nothoscordum bivavle*, and *Woodsia obtusa*. The number of plants at a single site can vary dramatically, with populations numbering from four to several thousand individuals.

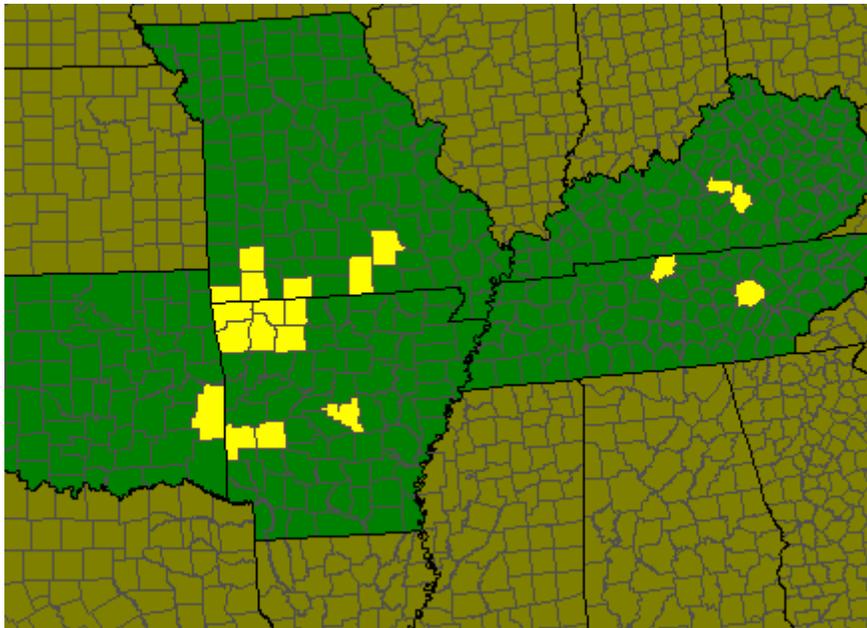
*Trillium pusillum* var. *ozarkanum* is a perennial herb that may bloom from March to early May. The plant is one of the earliest blooming in the Oklahoma Spring flora, avoiding shading by the forest canopy. There are typically three stages of growth found within a population of *Trillium pusillum* var. *ozarkanum*: one-leaved plants, three-leaved plants, and flowering plants. Flowering occurs when the plant is three to six years of age, varying with environmental factors such as soil type and the degree of shading. Fruits mature within a few weeks following bloom. A large number of viable seeds are produced, although up to two years may be required for seed germination. Seeds are likely dispersed by ants. Little vegetative reproduction occurs. Plants senesce in June and July (Cabe and Worth 1995, Oklahoma Natural Heritage Inventory 1999, Missouri Department of Conservation 2004, Andre et al. 2006, NatureServe 2006).

## E. Related Species

In Oklahoma, all other *Trillium* species (*T. recurvatum*, *T. sessile*, and *T. viridescens*) have sessile flowers that are brown-purple to green-yellow in color. *Trillium pusillum* var. *ozarkanum*'s flowers are white to pink and have a small peduncle. Other varieties of *T. pusillum*, including var. *pusillum* and var. *virginianum*, have more weakly defined nerves on their leaves and shorter petals than var. *ozarkanum*. Neither of these varieties is found in Oklahoma. (Taylor and Taylor 1991, Oklahoma Natural Heritage Inventory 1999, NatureServe 2006)

## F. Geographical Distribution

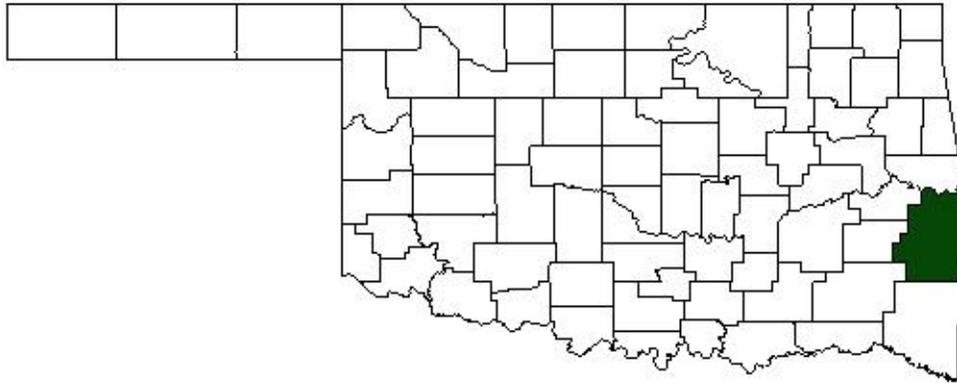
*Trillium pusillum* var. *ozarkanum* is found in the states of Arkansas, Kentucky, Missouri, Oklahoma, and Tennessee.



Distribution of *Trillium pusillum* var. *ozarkanum* in the United States (Kartesz and Meacham 2004).

In the map above, dark green indicates the possible historical range of *Trillium pusillum* var. *ozarkanum*. Yellow indicates known but rare populations of the plant (Kartesz and Meacham 2004).

In Oklahoma, the plant is only known from LeFlore County.



Distribution of *Trillium pusillum* var. *ozarkanum* in Oklahoma (Hoagland et al. 2006).

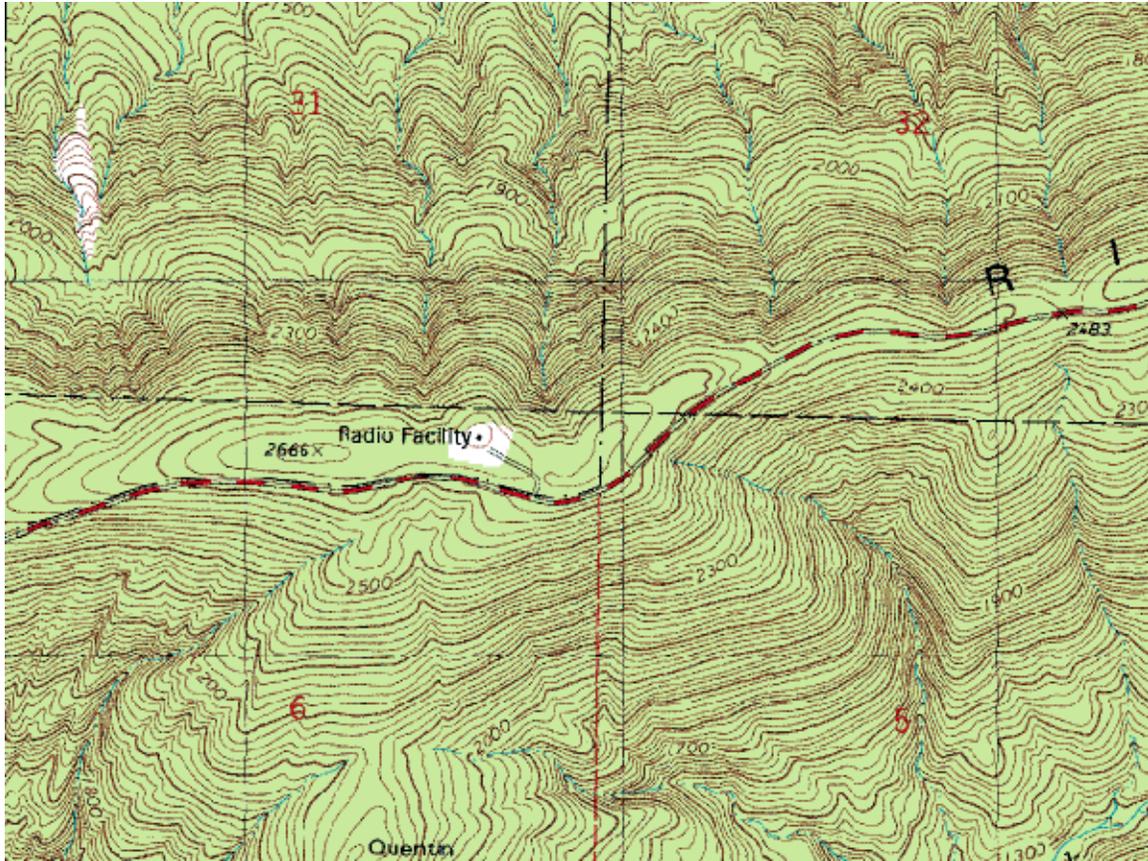
#### G. Historic Sites

Based on two herbarium collections from the Bebb Herbarium at the University of Oklahoma, there is only one known historic Oklahoma site for *Trillium pusillum* var. *ozarkanum* (Hoagland et al. 2006):

Accession number 212301, collected by L. Watson, May 19, 1989. From LeFlore County, OK, Ouachita National Forest, Talimena Scenic Drive at Kiamichi Mountain Overlook, Rich Mountain, north slope. T3N R26E section 32 (latitude/longitude not noted).

Accession number 186616, collected by N. McCarty, April 21, 1991. From LeFlore County, OK, Kiamichi Valley Vista, on state highway 1, Rich Mountain, oak and hickory forest, upper north facing slope. T2N R26E section 6 (latitude/longitude not noted).

The second record likely contains errors in the township and section numbers, as this area is a south-facing slope with unsuitable habitat. It is most likely the location of the parking lot for the T3N R26E section 32 site.



Topographic map of the general location of the Watson and McCarty collections (TopoZone 2006).

#### H. Current Sites

The only currently known site for *Trillium pusillum* var. *ozarkanum* is the same as the historical site (LeFlore County, OK, Ouachita National Forest, Talimena Scenic Drive at Kiamichi Mountain Overlook, Rich Mountain, T3N R26E section 32, 34° 40.84'N 94° 36.36'W (WGS84/NAD83). This site covers approximately one acre and includes approximately 1,000 plants.

### III. Study site

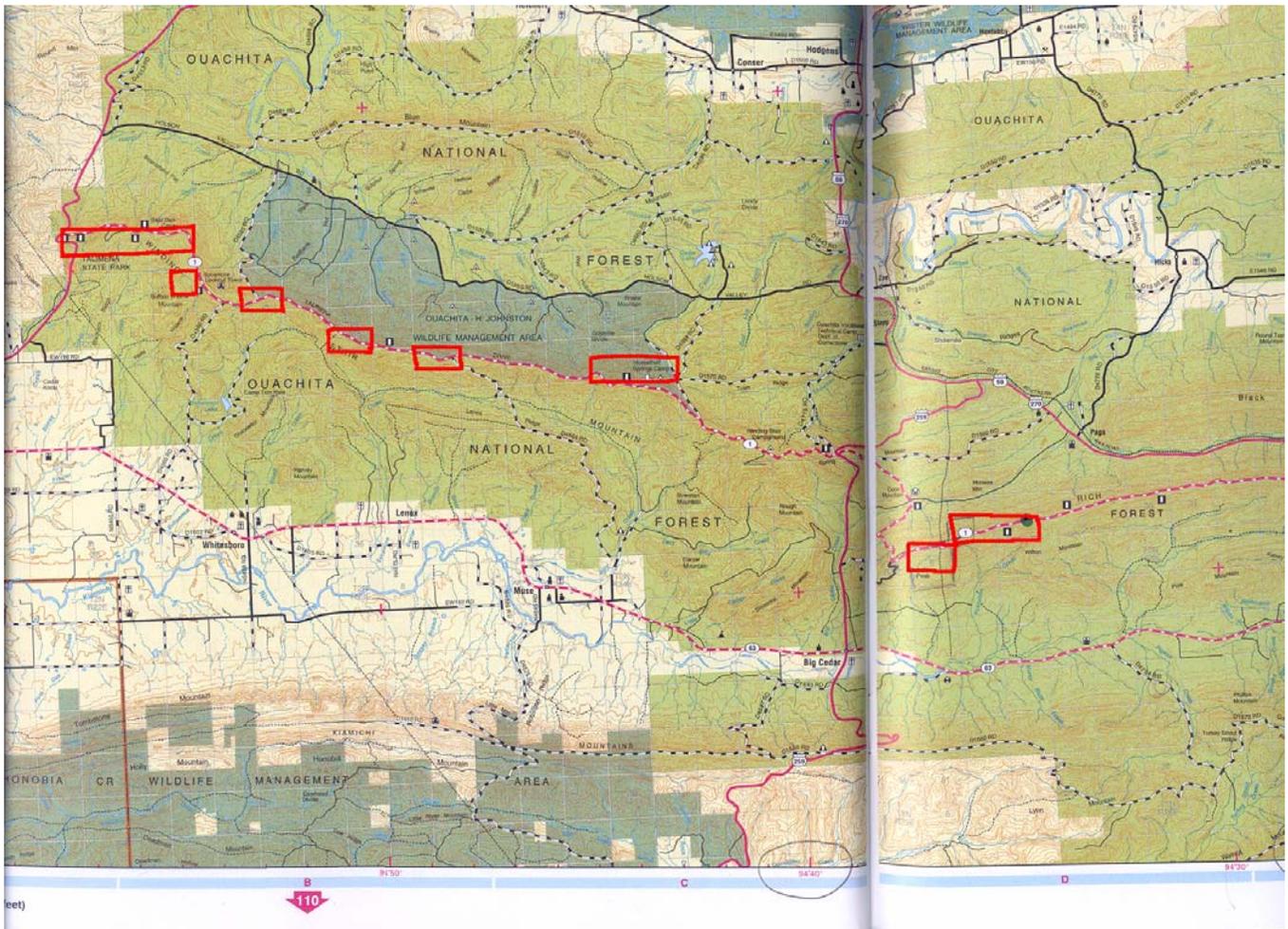
#### A. General Location

Field work for this project took place in LeFlore County, Oklahoma, along the Talimena Drive (highway 1), between Talihina, Oklahoma, and the Arkansas border. The areas surveyed included dry oak-hickory-pine forests. Soil types encountered included Hanceville rough stony loam and Hanceville stony loam (Knobel 1933). Species encountered included *Carex pennsylvanica*, *Dichanthelium* sp., *Elymus* sp., *Monarda russeliana*, *Phlox pilosa*, *Prunus serotina*, *Ostrya virginiana*, and *Viola* sp.

#### IV. Field Work

##### A. Sample Sites/Study Area

Areas around the Talimena Scenic Drive in LeFlore County, Oklahoma were selected to survey for populations of *Trillium pusillum* var. *ozarkanum*. This area included the historic sites of the Watson and McCarty collections. The new areas searched were similar to the historic site in terms of habitat types, soil types, and associated species. The following 12 areas were extensively searched by foot for populations of the plant: south half of T3N R26E section 32, north half of T2N R26E, north half of T4N R22E section 25, north half of T4N R23E section 30, north half of T4N R23E section 29, northeast quarter of T4N R23E section 32, south half of T4N R23 E section 34, south half of T3N R23E section 1, north half of T3N R24E section 8, south half of T3N R24E section 12, south half of T3N R25E section 7, and south half of T3N R26E section 33.



Areas surveyed for *Trillium pusillum* var. *ozarkanum* (in red).

## B. Surveyors/Observers

All areas were surveyed by Amy K. Buthod and Bruce W. Hoagland of the Oklahoma Natural Heritage Inventory.

## C. Time/Duration/Frequency

All surveying activities took place on March 24, 2005 and March 31, 2005. All sites were surveyed by foot over a period of approximately eight hours for two days.

## D. Methods

*The Oklahoma Vascular Plants Database* was consulted to locate herbarium specimens of *Trillium pusillum* var. *ozarkanum* (Hoagland et al. 2006). Information from the herbarium specimen labels, including historic locations and habitat types, led us to select areas around the Talimena Scenic Drive for surveys for additional populations. Surveys for the plant were done in a random fashion. Suitable habitats were slowly walked and scanned for any signs of the plants.

The following methodology was utilized for surveying populations of *Trillium pusillum* var. *ozarkanum*. The southeastern corner of the approximately one acre population was marked using a GPS unit to record the UTM coordinates using the WGS 84 system. Densitometer readings were taken from the approximate four corners and center of the population. These were averaged to get the percentage of canopy cover of the population. A measurement of the depth of the soil was taken at the southeastern corner of the population, using a marker in centimeters. Soil samples were taken from the approximate four corners and center of the plot. These samples were combined to form a conglomerate and sent to the soil labs for testing of pH, percentage of organic matter, and N, P, and K levels. The community type was noted. Twenty 1.0 m<sup>2</sup> PVC plots were placed randomly throughout the population. Associated species in each plot were recorded, and their percentage of cover within the plot was estimated. The percentage cover of rocks and leaf litter in the plot was also estimated. The total number of *Trillium pusillum* var. *ozarkanum* individuals present in the plot was noted. The numbers of stems in flower, numbers of stems in fruit, numbers of immature stems, and numbers senescent stems were recorded. Information regarding overall population vigor and evidence of disease or herbivory was noted.

## E. Data Analysis

Canopy cover for the population is estimated at 10%, although densitometer readings were taken before the majority of the trees had begun to produce leaves. Soil was very shallow at the site, measuring approximately 5.0 cm in depth. The soil sample collected was not large enough for proper testing. The average number of plants was of 8.5 per m<sup>2</sup>. The average number of flowering plants was 5.5 per m<sup>2</sup>. The average number of immature plants was 3.0 per m<sup>2</sup>. The average percent cover of *Trillium pusillum* var. *ozarkanum* was 1.9% per m<sup>2</sup>. Leaf litter, at 61.5% per m<sup>2</sup>, and rocks, at 3.1% per m<sup>2</sup>, were the main constituents of the

plots. Associated species were few, but this was because of the earliness of the season. An *Elymus* sp. occurred most frequently, appearing in seven of the 20 plots with an estimate of 0.8 plants per m<sup>2</sup>. A table describing the break-down of the *Trillium pusillum* var. *ozarkanum* age structure and associated species is below and also in a spreadsheet on the included CD.

Trillium Stems	Plot 1	2	3	4	5	6	7	10	11	12	13	14	15	16	17	18	19	20
# Flowering	10	16	9	13	5	10	1	2	2	5	4	1	4	3	6	4	3	11
# Fruiting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Immature	16	2	1	9	5	6	5	0	5	1	0	0	3	1	2	0	3	1
# Senescent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# Total	26	18	10	22	10	16	6	2	7	6	4	1	7	4	8	4	6	13

#### % Cover in Plots

Trillium pusillum var. ozarkanum	5	5	5	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1
Leaf litter	70	85	60	60	80	75	80	75	80	50	75	80	70	70	60	50	60	50
Carex pennsylvanica	15	5	5	5	5	5	5	15	15	50	10	15	20	40	50	30	30	30
Prunus serotina	0	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Ostrya virginiana	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichanthelium sp.	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Phlox pilosa	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Monarda russelliana	0	0	0	0	1	1	0	1	1	1	1	1	0	1	0	1	1	1
Rocks	5	5	5	5	25	5	5	0	0	0	5	0	0	0	0	0	1	0
Rubus sp.	0	0	0	0	0	1	5	0	0	0	1	1	0	0	1	0	0	0
Zizia sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Asteraceae unknown	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0
Chasmanthium sp.	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
Carex sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vaccinium pallidum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cardamine concatenata	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Erigeron sp.	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0
Vitis sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Smilax tamnoides	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Elymus sp.	0	0	0	0	0	0	0	0	0	5	0	0	1	1	5	1	1	1
Quercus alba	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
Viola sp.	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0
Poaceae unknown	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
Carya cordiformis	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Galium sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Geum canadense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

The population is on land owned by the United States Forest Service and is likely to remain protected. There was no evidence of disease or herbivory.

#### V. Results

#### A. Sites Not Sampled and Objectives Not Met

All located populations were sampled. However, only one population was located. Soil chemistry was not analyzed because of an insufficient sample size.

#### B. Sites Successfully Sampled

One population of *Trillium pusillum* var. *ozarkanum* was successfully located and sampled. Canopy cover for this population is estimated at 10%. Soil was very shallow, measuring approximately 5.0 cm in depth. The soil sample collected was not large enough for proper testing. The average number of plants was of 8.5 per m<sup>2</sup>. The average number of flowering plants was 5.5 per m<sup>2</sup>. The average number of immature plants was 3.0 per m<sup>2</sup>. The average percent cover of *Trillium pusillum* var. *ozarkanum* was 1.9% per m<sup>2</sup>. Leaf litter, at 61.5% per m<sup>2</sup>, and rocks, at 3.1% per m<sup>2</sup>, were the main constituents of the plots. Associated species were few, but this was because of the earliness of the season. An *Elymus* sp. occurred most frequently, appearing in seven of the 20 plots.

#### C. Photographs

Please see the included CD for photos of *Trillium pusillum* var. *ozarkanum*.

#### D. Data Forms

Scans of the original data sheets are below.



Population

Species T.P.O  
 Date 3/29/5  
 Location #/

Observers BH, AB  
 Plot Size 1x1  
 % Cover in Plot 5%

#Stems 20  
 #In Flower 10

#In Fruit 0  
 #Mature

#Immature 10  
 #Senescent 0

Overall Population Vigor +

Disease or Predation?

Drawing of Plot:

Plot	2	3	4	5	6	7	8	9	10
# stems	18	10	22	10	16	6	2	3	2
# fl	16	9	13	5	10	1	2	3	2
# immat	2	1	9	5	6	5	0	0	0
l. cov	85	60	60	80	75	80	60	80	75
Carex pen	5	5	5	5	5	5	0	10	15
Prunus ser.	5	0	0	0	0	0	5	1	1
Trollius pus.	5	5	5	4	5 (one decapitated)	1	1	1	1
Ostrya	0	0	1	0	0	0	0	0	0
Desmodium	0	0	1	1	0	0	0	0	0
Phlox pilosa	0	0	0	1	1	0	1	1	1
Monarda russ.	0	0	0	25	5	5	0	1	0
Rocks	0	5	5	0	1	5	0	1	0
Rubus	0	0	0	0	1	0	0	0	0
Zizia	0	0	0	1	1	0	0	0	0
unk comp	1	1	1	0	0	5	0	0	0
Chamaenerion	0	0	0	0	0	0	25	0	0
Sparganium (L.)	0	0	0	0	0	0	50	0	0

	11	12	13	14	15	16	17	18	19	20
# stems	7	6	4	1	7	4	8	4	6	13
# fl	2	5	4	1	4	3	6	4	3	12
# immat.	5	1	0	0	3	1	2	0	5	1
% cover	1	1	1	1	1	1	1	1	1	1
Liter	80	50	75	80	70	70	60	50	60	50
rocks	0	0	5	0	0	0	0	0	1	0
Canx pen	15	50	10	15	20	40	50	30	30	30
Cardamine conat	1	0	0	0	0	0	0	0	0	0
Monarda	1	1	1	1	0	1	0	1	1	1
Erigeron sp.	1	1	0	0	0	0	0	1	0	0
Vitis	1	0	0	0	0	0	0	0	0	0
Smilax tam	0	1	0	0	0	0	0	0	0	0
Elymus sp.	0	5	0	0	1	1	5	1	1	1
Q. alba	0	0	1	0	0	0	1	0	0	0
Rubus	0	0	1	1	0	1	1	0	0	0
Viola	0	0	1	0	1	1	0	0	0	0
unk grass	0	0	1	1	1	0	0	0	0	0
Carya cord.	0	0	0	0	1	0	0	0	0	0
Phlox pilosa	0	0	0	0	1	1	0	0	0	0
Galium (rounded leaves)	0	0	0	0	0	0	0	1	0	0
unk comp	0	0	0	0	0	0	0	1	0	0
						genm can			Parasitic	

## VI. Discussion

### A. Interpretation/Assessment

We estimated the population of *Trillium pusillum* var. *ozarkanum* at the approximately one acre site at 1,000 plants, with an average number of 8.5 plants per m<sup>2</sup>. This is a significantly smaller number than the count of 100,000 plants given in a 1991 account (Watson 1991). However, after investigating this 1991 paper, we have come to the conclusion that this estimate was incorrectly calculated. Since this is the only population in the state of Oklahoma, future monitoring should occur to determine if it is in fact in decline or stable. Areas with similar habitats were extensively searched, but no new populations were located. With more survey work, it is possible that more populations of *Trillium pusillum* var. *ozarkanum* may be located.

Canopy cover at the site was low, but this is to be expected as sampling occurred very early in the growing season. Associated species were few, but this can also be explained by the early date.

The main threat for *Trillium pusillum* var. *ozarkanum* populations is habitat destruction. Fortunately, the Oklahoma population is on land owned by the United States Forest Service and is likely to remain protected. It is located on the Talimena Scenic Drive, and the area is unlikely to be logged or sprayed with herbicides. There have been reports of insects feeding on ripened fruits, but in the Oklahoma population there was no evidence of herbivory or disease.

### B. Successfulness

We were mostly successful in sampling the one population of *Trillium pusillum* var. *ozarkanum* that was located. Soil sampling was unsuccessful due to the sparseness of the sample taken. Much larger soil samples should be taken in the future.

### C. Next Steps

Monitoring of this population should continue. Since this is the only known population in the state of Oklahoma, future monitoring should occur to determine if it is in decline or stable. Surveys of areas in the Ouachita National Forest should continue, as it is possible that more populations of *Trillium pusillum* var. *ozarkanum* may be located.

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## IIIX. Appendices

### A. Completed Data Sheets

Scans of data sheets are on the included CD.

### B. Data Results Spreadsheet

Please see the included CD for data in spreadsheet form.

### C. Other Materials

There are no other materials associated with this project.