

**Utilizing Standardized Protocols for Monitoring Vascular Plants of Federal
Concern: A Continuing Study with *Castanea pumila* var. *ozarkensis***

a report submitted by
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I. Species information—*Castanea pumila* var. *ozarkensis*

A. Nomenclature, classification, and taxonomic information

Scientific name

Castanea pumila (L.) P. Mill. var. *ozarkensis* (Ashe) Tucker

Valid synonyms

Castanea alabamensis Ashe

Castanea ozarkensis Ashe

Castanea ozarkensis Ashe var. *arkansana* (Ashe) Ashe

Classification

Kingdom—Plantae (plants)

Subkingdom—Tracheobionta (vascular plants)

Superdivision—Spermatophyta (seed plants)

Division—Magnoliophyta (flowering plants)

Class—Magnoliopsida (Dicotyledons)

Subclass—Hamamelidae

Order—Fagales

Family—Fagaceae (beech family)

Genus *Castanea* P. Mill. (chestnut)

Species—*Castanea pumila* (L.) P. Mill. (chinquapin)

Variety—*Castanea pumila* (L.) P. Mill. var. *ozarkensis* (Ashe) Tucker (Ozark chinquapin)

Bibliographic citation

Gary E. Tucker, in Proceedings of the Arkansas Academy of Science 29: 68 (1975).

Type specimen

W. W. Ashe, s.n., from Searcy County, Arkansas, September 17, 1923, University of North Carolina (NCU) accession number 64311. Ashe did not designate type specimens in his original description of *Castanea ozarkensis*. This lectotype was selected by Tucker.

Common name

Ozark chinquapin

USDA code

CAPUO

History of knowledge

Castanea pumila var. *ozarkensis* was originally described by Ashe in 1923 as a new species (*C. ozarkensis*). A second Ozarkian species, *C. arkansana*, was described by Ashe at the same time based on differences in leaf pubescence. It was later reduced to a variety of *C. ozarkensis* and then to synonymy with *C. ozarkensis*. *C. ozarkensis* was reduced to a variety of *C. pumila* in the 1970's after a review of herbarium specimens uncovered the extreme intergradations of morphological characters that occur throughout the *C. pumila* group. Another species, *C. alabamensis*, was reduced to synonymy with *C. pumila* var. *ozarkensis* in the 1990's by Kartesz.

Current alternative taxonomic treatment

There is currently no alternative taxonomic treatment for *Castanea pumila* var. *ozarkensis*.

B. Present legal or other conservation status

Federal

Castanea pumila var. *ozarkensis* currently has no federal status. Prior to 1996 it was a category 2 (C2) for listing.

C2="A likely candidate for federal listing as endangered or threatened, but it is necessary to obtain further information regarding possible threats" (Department of the Interior, 1993).

State

The status of *C. pumila* var. *ozarkensis* in states reported to have populations of the plant is as follows: Oklahoma, none; Alabama, none; Arkansas, INV; Louisiana, none; Mississippi, none; Missouri, none.

INV=Inventory element. "The Arkansas Natural Heritage Commission is currently conducting active inventory work on these elements. Available data suggests these elements are of conservation concern" (Arkansas Natural Heritage Commission, 2001).

C. Global and state rankings

Global

Castanea pumila var. *ozarkensis* has a global ranking of G5T3. *C. pumila* is a widespread species, but the varietal form (*ozarkensis*) is "restricted to a narrow range largely within the Ozark Highlands, where it is threatened by chestnut blight" (NatureServe, 2005).

G5="Demonstrably secure globally though it may be quite rare in parts of its range, especially at the periphery" (Oklahoma Natural Heritage Inventory, 2001).

T3="Vulnerable to extirpation or extinction" (NatureServe, 2005). A "T rank" is used for infraspecific taxa.

State

The ranks of *C. pumila* var. *ozarkensis* in states reported to have populations of the plant are as follows: Oklahoma, S2; Alabama, SH; Arkansas, S3S4; Louisiana, S1; Mississippi, not ranked; Missouri, S2.

S1="Critically imperiled...because of extreme rarity...or because of some factor of its biology marking it especially vulnerable to extinction" (Oklahoma Natural Heritage Inventory, 2001).

S2="Imperiled...because of extreme rarity (six to 20 occurrences or few remaining individuals or acres) or because of other factors making it very vulnerable to extinction throughout its range" (Oklahoma Natural Heritage Inventory, 2001).

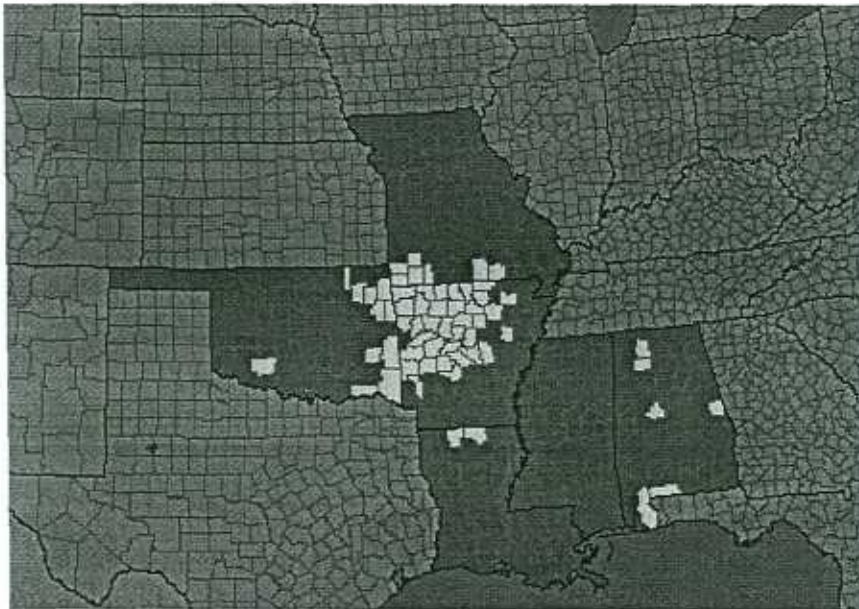
S3= "Rare or local...(though it may be abundant at some of its locations); in the range of 21-100 occurrences" (Oklahoma Natural Heritage Inventory, 2001).

S4="Apparently secure" (Oklahoma Natural Heritage Inventory, 2001).

SH="Historically known, but possibly extirpated; not seen in the last 15 years" (Oklahoma Natural Heritage Inventory, 2001).

D. Geographical distribution

Ozark chinquapin is found in the Ozark Plateau region and the Ouachita Highlands, typically at elevations from 150.0 m to 850.0 m. Populations occur in Alabama, Arkansas, Louisiana, Mississippi, Missouri, and Oklahoma. In Oklahoma, the plant is reported from Adair, Cherokee, Choctaw, Delaware, Latimer, Leflore, Mayes, and McCurtain counties.



Distribution of *Castanea pumila* var. *ozarkensis* within the United States. (Kartesz and Meacham, 2004). The record from Comanche County, Oklahoma is an error (Hoagland, 2006).

E. General habitat description

Castanea pumila var. *ozarkensis* grows in upland oak-hickory forests and oak-pine forests. The plant typically is found on dry acidic soils on ridges and ravine slopes. Historically, Ozark chinquapin may have been common in thin woodlands and woodland margins. Foresters have reported that the chinquapin will appear in areas that have been newly cleared, leading scientists to conclude that the plant gets established and survives as a long-lived seedling until the canopy opens up enough for growth and reproduction (Paillet, 2002).

F. Morphology, life history, and related species

Castanea pumila var. *ozarkensis* is a perennial tree or shrub. Because of the effects of the fungal disease chestnut blight (*Cryphonectria parasitica*, formerly *Endothia parasitica*), Ozark chinquapin typically grows in small groups that are stump sprouts from the root collar of an older, blighted tree. Plants are usually less than 5.0 m in height, but can be as tall as 10.0 m. Crown width can be up to 6.0 m. The bark of the Ozark chinquapin is gray to grayish brown in color, with hairless, gray-colored branchlets. Leaves are 13.0-20.0 cm in length, broadly lanceolate to oblong, and coarsely toothed. Upper leaf surfaces are glabrous and greenish-yellow. There may or may not be pubescence on the underside. Petioles are glabrous. Flowers are white, imperfect, apetalous, and scented. The inflorescence is a dense catkin 5.0-20.0 mm in length. Inflorescences are exclusively male-flowered or may have a few female flowers near the base. Fruits are produced in burrs with hairy spines. Nuts are small, round, and brown in color.

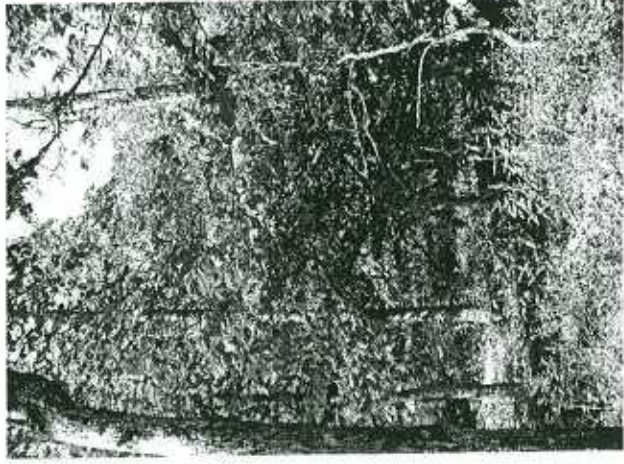
Ozark chinquapin flowers from May through June and produces fruits from June through September. The plant is monoecious, but cross pollination may be required for the production of viable seed (Elias, 1971). The plant is primarily wind pollinated.

In the field, Ozark chinquapin could be mistaken for chinquapin oak (*Quercus muehlenbergii*), but the latter has leaves with rounded teeth and buds clustered at the stem's apex. *Castanea pumila* var. *pumila* (Allegheny chinquapin) has much smaller leaves than variety *ozarkensis*, grows in sandy soil, and is rare in the Ozark Plateau region. The two varieties may also differ in flavonoid content (Dane et al., 1999). *Castanea dentata*, the American chestnut, is found in the eastern United States and has broader leaves with smaller teeth and smaller burrs.

G. Photos



Castanea pumila var. *ozarkensis* individual.



Castanea pumila var. *ozarkensis* individual.

II. Field work

A. Experimental methods

Sites with dead or alive Ozark chinquapins present were selected. Plots of 30.0 m by 30.0 m were established at each site. Permanent photo points were selected and marked, and photos were taken at these points. UTM information was recorded at the photo point using a Garmin III plus GPS unit. A rough sketch was made of each plot. Canopy cover was recorded at the center and at each corner of the plot using a densitometer. Soil depth was measured. Soil samples were collected for analysis by removing small quantities from the center and each of the four corners of the plot. Unfortunately, the analyses could not be completed due to increased gasoline and travel costs. All woody species with a diameter of greater than 2.0 cm were measured. Other associated species and their percent coverage within the plot were noted.

Three types of Ozark chinquapins were encountered. The majority were root sprouts from "clumps" that included dead stems. The diameter of each "clump" was measured, and the living stems were counted. A second type of individual consisted of a dead crown without living sprouts, and these diameters were also recorded. Individuals not related to clumps were also present in some of the plots, and these were counted and measured. The presence of buds, flowers, or fruits was noted.

B. Sampled sites

The following is a summary of the data from the *Castanea pumila* var. *ozarkensis* sites sampled. Detailed data sheets and original data sheets can be found in the appendix section of the report.

Site name: OUA1

Date Observed: June 21, 2004

Surveyors: Amy Buthod, Bruce Hoagland, and Susan Hooks

Location: 15S 0359341 3828624; Ouachita National Forest, LeFlore County, Oklahoma

Percent coverage by Ozark chinquapin: <5.0%

Clumps with root sprouts: 8

Average diameter of clump: 47.0 cm

Clumps without root sprouts: 0

Average diameter of clump: 0

Number of individuals: 1

Canopy cover: 70.3%

Soil depth: <10.0 cm

Community type: Oak-hickory forest, with the oaks in decline

Associated species: *Quercus falcata*, *Rubus* sp., *Hypericum prolificum*,
Lespedeza repens

Evidence of reproduction: One clump with root sprouts had a branch bearing burrs.

General comments: The red oaks in this plot are experiencing decline.

Site name: OUA2

Date Observed: August 10, 2005

Surveyors: Amy Buthod and Bruce Hoagland

Location: 15 S 0360322 3826074; Beech Creek National Scenic Area, Ouachita National Forest, LeFlore County, Oklahoma

Percent coverage by Ozark chinquapin: <5.0%

Clumps with root sprouts: 0

Average diameter of clump: 0 cm

Clumps without root sprouts: 0

Average diameter of clump: 0

Number of individuals: 6

Canopy cover: 95.4%

Soil depth: <10.0 cm

Community type: Oak-beech-maple forest

Associated species: *Quercus alba*, *Fagus grandifolia*, *Acer rubrum*, *Vaccinium pallidum*, *Ilex opaca*

Evidence of reproduction: There is no evidence of reproduction. All individuals have a DBH of less than 2.0 cm.

General comments: There is some evidence of herbivory on the leaves of the plant.

Site name: OUA3

Date Observed: September 1, 2005

Surveyors: Amy Buthod and Bruce Hoagland

Location: 15S 0347606 3842085; Talimena Drive, Ouachita National Forest, LeFlore County, Oklahoma

Percent coverage by Ozark chinquapin: <5.0%

Clumps with root sprouts: 5

Average diameter of clump: 23.6 cm

Clumps without root sprouts: 0

Average diameter of clump: 0

Number of individuals: 3

Canopy cover: 80.2%

Soil depth: <10.0 cm

Community type: Oak-pine forest

Associated species: *Quercus velutina*, *Pinus echinata*, *Vaccinium pallidum*, *Vaccinium stamineum*

Evidence of reproduction: There is no evidence of reproduction.

General comments: .Some of the larger stems in this plot show signs of chestnut blight. There is some evidence of herbivory on the leaves.

Site name: OUA4

Date Observed: September 1, 2005

Surveyors: Amy Buthod and Bruce Hoagland

Location: 15S 0347466 3842104; Talimena Drive, Ouachita National Forest, LeFlore County, Oklahoma

Percent coverage by Ozark chinquapin: <5.0%

Clumps with root sprouts: 18

Average diameter of clump: 24.2 cm

Clumps without root sprouts: 0

Average diameter of clump: 0

Number of individuals: 0

Canopy cover: 53.4%

Soil depth: <10.0 cm

Community type: Pine woodland

Associated species: *Pinus echinata*, *Quercus velutina*, *Vaccinium pallidum*, *Vaccinium stamineum*

Evidence of reproduction: Three stems have immature fruits.

General comments: Many living stems show evidence of chestnut blight. Recently dead stems with evidence of blight are also present. There is some evidence of herbivory on the leaves.

Site name: OUA5

Date Observed: September 1, 2005

Surveyors: Amy Buthod and Bruce Hoagland

Location: 15S 0347431 3842153; Talimena Drive, Ouachita National Forest, LeFlore County, Oklahoma

Percent coverage by Ozark chinquapin: 5.0%

Clumps with root sprouts: 9

Average diameter of clump: 30.4 cm

Clumps without root sprouts: 0

Average diameter of clump: 0

Number of individuals: 2

Canopy cover: 55.9%

Soil depth: <10.0 cm

Community type: Pine woodland

Associated species: *Pinus echinata*, *Quercus marilandica*, *Vaccinium pallidum*, *Vaccinium arboreum*

Evidence of reproduction: There is no evidence of reproduction.

General comments: Many stems show evidence of chestnut blight. There is some evidence of herbivory on the leaves.

Site name: OUA6

Date Observed: September 2, 2005

Surveyors: Amy Buthod and Bruce Hoagland

Location: 15S 0366369 3839082; Ouachita National Forest, LeFlore County, Oklahoma

Percent coverage by Ozark chinquapin: <5.0%

Clumps with root sprouts: 2

Average diameter of clump: 24.0 cm

Clumps without root sprouts: 0

Average diameter of clump: 0

Number of individuals: 1

Canopy cover: 96.7%

Soil depth: <10.0 cm

Community type: Beech-pine forest

Associated species: *Fagus grandifolia*, *Pinus echinata*, *Ostrya virginiana*,
Vaccinium pallidum

Evidence of reproduction: There is no evidence of reproduction.

General comments: Many living stems show evidence of chestnut blight. There is some evidence of herbivory on the leaves.

C. Sites located but not sampled.

The following sites are known to have specimens of *Castanea pumila* var. *ozarkensis*, but were not sampled.

Site Name: Beech Creek Trail

Location: 15 S 364605 3827379; Beech Creek Trail, Ouachita National Forest, LeFlore County, Oklahoma. As many as 15 individuals were counted, but sampling was not done due to concerns about an adjoining landowner.

Site Name: Cucumber Creek

Location: 15 S 364605 3827379; The Nature Conservancy's Cucumber Creek Nature Preserve, LeFlore County, Oklahoma. This site includes one small seedling. Sampling did not occur because the leaves had already fallen and the tree could not be relocated. An additional large, reproducing tree is also known from the area

D. Historical sites

The following is a list of historical sites in the Ouachitas for *Castanea pumila* var. *ozarkensis* based on records from the Oklahoma Vascular Plants Database (Hoagland et al., 2005). The descriptions of these sites are vague and the trees were not relocated.

Accession Number	Collector	Collection Number	Collection Date	County	Location	Habitat
OKL15747	G. W. Stevens	2663	September 8, 1933	LeFlore	Page, near Page, Rich Mountain	Base of mountain
OKL15748	O. W. Blakley	3448	July 15, 1915	LeFlore	Page, near Page, Rich Mountain	Open wood, base of mountain
OKL15749	A. & R. Nelson & G. J. Goodman	5598	April 21, 1946	McCurtain	Broken Bow; Ouachita Mountains, 15.0 mi N of Broken Bow	Dry wooded ridge
OKL15751	R. Pearce	1452	July 18, 1964	McCurtain	Sherwood; State Game Preserve 5.0 mi E of Sherwood	Forest
OKL55848	H. F. Duckett	215	August 14, 1933	LeFlore	Unknown	Mountains

E. Other sites

Mr. Joe Glenn of Hodgen, OK has worked extensively with *Castanea pumila* var. *ozarkensis* in the Ouachitas. A copy of his work may be found in the appendix.

III. Current assessment of *Castanea pumila* var. *ozarkensis* in the Oklahoma Ouachitas

Chestnut blight continues to threaten populations of *Castanea pumila* var. *ozarkensis*. Other threats include timber harvesting activities that may injure the root crowns of old trees, thereby hindering root sprouting. Within the National Forest, where most of the trees are located, timber harvesting is monitored for accidental crown impact. Herbicides are another threat, but are not allowed within 60.0 feet of any sprouts in the National Forest (Newman, 2002).

Castanea pumila var. *ozarkensis* is somewhat common throughout the Ouachitas and current populations should be maintained. Experiments relating to canopy cover and sprout formation have suggested that the plant responds positively to the removal of some cover (NatureServe, 2005; Paillet, 2002). Observations in the Ozark region indicate that trees in open areas are much more likely to reproduce (Buthod, 2004). Within the National Forest, many areas are being actively managed with fire, resulting in more open canopies. The spread of oak decline may have similar a similar effect.

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B. Knowledgeable persons

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Appendix A: Glenn Report

A preliminary Overview of A Survey For The Occurrence of The Ozark Chinquapin
In The Ouachita Highlands of Southeastern Oklahoma

Joe Glenn

Abstract

There currently exists a paucity of information concerning the occurrence of Ozark chinquapin (*Castanea ozarkensis* Ashe) in the Ouachita Highlands of southeastern Oklahoma. I attempt to locate and catalog occurrence sites in this region and ascertain the impacts of Chestnut blight (*Cryphonectria parasitica* (Murrill) Barr), as well as to identify any other potential threats to the survival of this species.

Methods

Field surveys were initiated in February of 2002. Survey sites were chosen based on the limited historical references to Chinquapin occurrence in the area and on interviews with older residents of the area who were familiar with the species. Identification was made using leaf, bark, twig, and bud structure. Occurrence site coordinates (UTM) and elevation were recorded using a hand-held GPS receiver and later checked against USGS 7.5 minute quad maps (referencing known topographical features of the area) to assure accuracy. Note was made of slope, aspect, forest type and structure, as well as plant species associations. Each individual specimen of *C. ozarkensis* was cataloged with notations of diameter, height, and health. Diameter measurements for small stems were taken at the base of the stem while diameter measurements for larger stems were taken at breast height (4 1/2'). Due to the preliminary nature of this paper, all references to abundance, age, and vigor are subjective rather than quantitative.

Study Area

The Ouachita Highlands encompass an area of approximately 300 km east to west and 100 km north to south in southeastern Oklahoma and western Arkansas with elevations ranging from 100m to 900m (Croneis 1930, Foti and Glenn 1991). The Ouachita Mountain region has a ridge and valley topography with ridges usually trending east to west. Primary substrates are marine sediments (predominantly sandstone and shale) from the Paleozoic era (Croneis 1930, Hatcher et al. 1989, Foti and Glenn 1991). The ridges were formed by uplift and folding associated with continental plate collision that occurred during the late Paleozoic era (approx. 280 million years before present) (Croneis 1930, Hatcher et al. 1989, Foti and Glenn 1991). Vegetation has varied dramatically in this region in the intervening years between the time of formation and the present due to factors such as climate change, natural disasters and anthropogenic disturbance, with the current Oak-Hickory-Pine forest that now dominates the region not becoming established until approx. 4000yr BP (Delcourt and Delcourt 1991).

Prior to the implementation of exploitive land use practices following Anglo-European settlement in the early 20th century, the region was comprised of a mosaic of mesic hardwood-dominated forests on north facing slopes and riparian areas, with xeric, open-canopy forests of mixed hardwood and pine occurring on south facing slopes and ridge tops, and savanna and prairie occurring in more frequently disturbed lowland areas (Foti and Glenn 1991, Kreiter 1995)

The present day forests of this region now differ greatly in composition from the pre-settlement forest due to secondary succession attributable to the elimination of old-growth forest by commercial diameter limit logging, open range grazing of domestic cattle and swine, and alteration of natural fire regimes (Foti and Glenn 1991, Kreiter 1995, Brantley and Platt 2001). The forest composition of the region now is predominantly dense second-growth ≤ 80 yr with many areas that were previously mesic hardwood forests now predominantly forested in *Pinus* spp. due to secondary succession, or, in some cases, intentional manipulation (pers. observ.).

Historical Perspective

Documented historical references to the occurrence of Ozark chinquapin in southeastern Oklahoma are rare. E. J. Palmer conducted a specimen collection field trip to Rich and Black Fork mountains near Page, Oklahoma in southeastern LeFlore county in the early 1920's and noted the occurrence of what he described as *Castanea pumila* on the north facing slopes of both mountains (Palmer 1924, Foti and Glenn 1991). Ashe's designation of *Castanea ozarkensis* as a separate species was not published until 1923 (Ashe 1923, Johnson 1988) and is the probable reason for Palmer's use of the taxonomical designation *C. pumila*. Field surveys I conducted on the north slopes of Black Fork and Rich mountains in the vicinity that Palmer surveyed resulted in the discovery of numerous specimens of *C. ozarkensis*, but none of *C. pumila*.

Local residents that I interviewed recalled the Ozark chinquapin as being abundant in the mountains. Few could give details of exact locations, but most advised me that they had been particularly abundant on the crest and upper south slope of Rich Mountain.

Herbarium specimens of *C. ozarkensis* have been collected from Choctaw, Latimer, LeFlore and McCurtain counties in southeastern Oklahoma (Johnson 1988, Oklahoma Biological Survey web site) with site elevations varying in elevation from 150m to 850m (Oklahoma Biological Survey web site).

The Ouachita National Forest currently reports nine occurrence sites within it's boundaries, with an additional ten occurrence sites reported on adjacent private lands (Bastarache 2002)

I was unable to locate any historical documentation of the arrival of Chestnut blight in the region, but the local residents I interviewed recalled that stem mortality began in the mid to late-1940's..

Observations

As of June 2002 I have cataloged 905 individual specimens at 99 sites within the boundaries of the Ouachita National Forest in LeFlore Co. OK. The vast majority of specimens consist of basal re-sprouts of previously killed stems. 14 live stems exceeding 6" dbh have been identified. An additional 23 stems that exceeded 6" dbh, but have suffered mortality within the last 10yr were also identified, including a massive stem of 22" dbh, 60' ht. that suffered mortality subsequent to a massive ice storm that struck the area in December of 2000. Twelve of the large live stems exhibit evidence of past attack by blight on their trunks, all have suffered attacks on limbs and branches to some degree. 36 specimens have been identified that are < 6" dbh but are mature enough to flower and produce fruit. Seedling establishment has been confirmed at one site and is strongly suspected at two other sites. Some of the specimens encountered consisted of small (usually < 3/4" dia, 4' ht) individually occurring suppressed stems that exhibit mature bark and appear to be what have been described as "old seedlings" (small stems that have originated from seed and persisted in a suppressed state for several decades awaiting release by canopy disturbance) (Paillet 1993), which suggests adaptation to infrequently disturbed late-successional habitats (Runkle 1991).

It appears that there has been an increase in stem mortality within the previous three years, with approx. 40% of stems located being \leq 3yr in age. This may be attributable to severe late summer drought and severe heat, which began in the summer of 1998 and persisted until the summer of 2000. Other stressing environmental factors, such as boring and defoliating insects have increased in this same time period and may also be a contributing factor to premature stem mortality. Top kill of 17 specimens is directly attributable to prescribed burning conducted by the U.S. Forest Service in April of 2002. The previously mentioned Dec. 2000 ice storm severely damaged most stems exceeding 3" dbh. 10 of the 14 live stems > 6" dbh have experienced moderate to severe crown damage from the ice storm but are regenerating limbs and appear to be recovering. I have observed only two cases where stem mortality was directly attributable to ice damage (complete breakage of the stem at the root collar), but it is probable that ice

damage has been a contributing factor in other stem mortality. Encroachment by competing vegetation appears to reduce stem vigor and promote premature stem mortality and may possibly contribute to root system mortality. Excessive shading appears to contribute to branch mortality and crown retardation

Some of the specimens appear to possess a relatively high resistance to blight, with some individuals surviving repeated attacks. Blight resistance appears to be a characteristic of individual trees rather than hypo-virulence of the blight fungus. Cankers formed as a result of hypo-virulence are usually swollen and bulbous in shape (Dr. Sandra Anagnostakis, Conn. Ag. Research Station, pers. comm.) while the cankers I observed on the resistant *C. ozarkensis* specimens in the study area are quite different in nature. Resistant trees are somehow able to restrict the horizontal growth of *C. parasitica* rhizomes, preventing them from completely encircling the stem. In some cases the rhizomes may then extend vertically along the stem creating a long, narrow elliptical shaped canker. The fungus eventually dies leaving a elliptical shaped patch of exposed sapwood that is eventually covered over by callous ridges of new bark.

The Ozark chinquapin appears to have no bias regarding slope or aspect with no discernable difference in abundance relative to these factors being observed. The most common feature of occurrence sites is abrupt change in topographical features that provide more or less permanent gaps in the forest canopy, or at least allow for greater light penetration to the forest floor. Common occurrence sites are talus flow margins, drainage margins, steep ($\geq 35\%$) upper slopes, large rock outcrops, narrow ridge tops (usually at intermediate elevations), benches and sharply descending points. .

Of the 99 occurrence sites documented, 91 are in mesic, closed canopy deciduous forest. The dominant over-story trees at most sites consist of *Quercus alba*, and *Quercus velutina*, with *Nyssa sylvatica*, *Prunus serotina*, *Carya tomentosa*, *Liquidambar styraciflua*, and *Acer saccharum* varying in importance depending on slope, aspect, and elevation. Common under-story species at occurrence sites include *Hamamelis virginiana*, *Sassafras albidum*, *Vaccinium pallidum*, and seedlings of dominant over-story species. At some of the wetter sites, *Ilex opaca*, *Ostrya virginiana*, and *Fagus grandifolia* are common under-story components. Many sites were in relatively undisturbed old-growth forest, the rugged topography having prevented commercial harvest in the early 20th century. These sites differ markedly from the second-growth sites, with a reduced basal area and a more open forest floor, a greater canopy height (60 -80ft.), and little or no mid-story. The *C. ozarkensis* specimens at these old-growth sites generally appear to be more vigorous, with denser foliage and more well developed crowns. The second-growth sites tended to have a much higher basal area, a lower overall canopy height (40 - 50'), and dense mid and under-stories. Conditions at these second-growth sites vary with age, with younger stands (30-60yr) being more dense and older stands (≥ 60 yr) being more open. The most common mid-story species in these second-growth stands are *Acer rubrum* and *Cornus florida*. *C. ozarkensis* specimens in these second-growth sites tended to be smaller in diameter and stature in comparison to specimens from old-growth sites. Crowns were also usually less well developed. Of the 8 xeric sites, only one appears to have been xeric in nature prior to Anglo-European disturbance. The 7 remaining xeric sites appear to be the result of recent disturbance, with the forest cover consisting predominantly of *Pinus echinata* ≤ 50 yr. Some of these contained scattered old-growth deciduous trees, suggesting that they had been mesic in nature prior to human disturbance. Under-stories in these mesic sites consists mainly of *Vaccinium pallidum*. Mid-successional species such as *Vaccinium arboreum* and *Cornus florida* are also prevalent. Three of the xeric site have previously undergone prescribed burning (two on Winding Stair Mt. one on Kiamichi Mt.) approx. 5yr BP, with an additional xeric site (Rough Mt.) undergoing prescribed burning in the early growing season (April) of 2002. Conditions in these burned areas are generally more open, although pine basal area is still high. Most deciduous stems ≤ 4 " dbh have been top killed, effectively eliminating the mid-story at these sites. The under-stories of these sites are now comprised of basal sprouts of top-killed deciduous stems and *Vaccinium pallidum*. With the exception of two specimens that were located on steep slopes that prevented the accumulation of fuel, all of the *C. ozarkensis* specimens in the three 5yr BP burn areas suffered top kill as a direct result of the fires. Five years after burning, these specimens now consist of small stems $\leq 5/16$ " diameter and 18" in height. While it would appear that the

reduction of competing vegetation would encourage vigorous growth of new sprouts, vigorous growth has not occurred at these sites.

At many sites (particularly talus flows) the remains of the original pre-blight stems are still present and provide valuable insight to the pre-blight growth form of *C. ozarkensis*. Some stems grew to impressive diameters (up to 30" dbh) with heights generally ranging from 35 to 50ft. It appears that basal sprouts were common to large mature specimens, with most large remnant stems exhibiting the remnants of at least one basal sprout. The large, recently killed stem mentioned previously possessed a basal sprout of 5" dbh, 35' ht. Some of the remnant pre-blight stems appear to be basal re-sprouts of previously killed stems, and consist of multiple stems of approx. the same diameter and height growing in a circular pattern, suggesting that they emanated from the same root collar. Some of these are quite large measuring up to 16" dbh, 35' ht. Almost all of the remnant pre-blight stems are hollow, with many exhibiting no more than 1"- 2" thickness of sapwood. One live stem and one recently killed stem (10" and 11" dbh respectively) that were broken at the root collar by the Dec. 2000 ice storm were also hollow, suggesting that *C. ozarkensis* in the study area are prone to heart rot. I speculate that this may be an evolutionary adaptation resultant from periodic disturbance factors such as ice storms and wind throw that have been common to this area (Runkle 1991). In response to these disturbance events, trees that were prone to heart rot were broken off above the root collar, leaving the root system in place to regenerate new stems, while more solid trees were uprooted and killed. After repeated disturbances over an extended period of time, trees prone to heart rot became predominant.

Discussion

Preliminary indications are that the Ozark chinquapin is common and abundant in the Ouachita highlands of southeastern Oklahoma. Abundance appears to be greatest in relatively undisturbed late-successional upland forests. The Ozark chinquapins' preference for later forest successional stages and areas of higher soil fertility have been previously documented by others (Johnson 1988). While I have observed *C. ozarkensis* growing in association with most of the common tree species of this area, the one notable exception has been *Quercus stellata* which is a fire tolerant species strongly associated with open savanna-like mid-elevation and lowland forests, as well as fire-prone xeric ridge tops (Foti and Glenn 1991). The failure to locate *C. ozarkensis* in association with *Q. stellata* may be indicative of the former species' intolerance of frequent fire. A demographically isolated population of *C. ozarkensis* once existed in northern Alabama, but is now reported to be extirpated from the region (Johnson 1988). Johnson examined several explanations for the disjunct distribution of *C. ozarkensis* between the southern Appalachians and the Interior highlands. One that was examined was the possibility that *C. ozarkensis* was once more broadly geographically distributed (Johnson 1988). It has been suggested that warm weather deciduous species were eliminated from most of their North American range by the Pleistocene glaciations and were re-established after the last glacial maximum (approx. 20,000yr BP) from refugia along the gulf coast (Johnson 1988, Delcourt and Delcourt 1991). It is possible that *C. ozarkensis* may have once occupied a much larger geographic region, including much of the gulf coastal plain, but was later eliminated from much of it's range by frequent anthropogenic disturbance during the Late Quaternary period. Alteration of vegetation patterns by frequent anthropogenic disturbances, such as cultivation and fire in the Late Quaternary period have been documented by others (Brantley and Platt 2001). The Ouachita National Forest regularly conducts prescribed burning within the Oklahoma Ranger District for a variety of reasons, including timber stand improvement, wildlife stand improvement, site preparation, and fuel reduction (ONF staff, pers. comm.). The current burning season is November to April (dormant season and early growing season). Research has shown that dormant and early season fires are effective in top-killing deciduous woody stems \leq 1 meter, and that repeated burning over an extended period may result in cumulative root system mortality (Sparks et al. 1999).

The Ozark chinquapin currently faces numerous threats to its continued existence. The most serious long-term threat is Chestnut blight, but other factors such as prescribed burning of mesic upland forests, conversion of native forest to commercial monoculture plantations, and mechanical damage from road

construction and timber harvest may further imperil the Ozark chinquapin if not adequately addressed. A multi-faceted conservation / recovery plan needs to be established for this species, directed at locating and cataloging existing specimens (especially large blight-resistant trees), developing a breeding program for blight-resistance, improving and administering biological controls for blight to improve the stature and reproductive capability of wild trees, reduction of competing vegetation in wild stands, and continuing research of the biology and natural history of this unique and fascinating species.

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Appendix B: Data in spreadsheet form

Site OUA1

15S 0359341 3828624

Crown diar # stems # stems w/burrs Genets

20	6		3
33	5		
67	14	1	
105	32		
55	13		
15	3		
23	12		

12.5
10.4
12
10.9
17.7
14.2
7.2
7.5
10.8
9.6
9.5
12.7
6.8
10.9
6.3

Helianthus hirsutus	1
Andropogon gerardii	1
Aster patens	1
Solidago ulmifolia	1
Clitoria mariana	1
Rubus sp.	10
Scleria sp.	1
Vaccinium pallidum	1
Dichantherium linear	5
Parthenocissus quin	1
Schizachyrium scopu	1
Hypericum prolificum	10
Antennaria plantagin	1
Potentilla simplex	1
Ruellia humilis	1
Galium arkansanum	1
Dichantherium boscii	1
Monarda virgata	1
Erechtites hieracifoli	1
Smilax glauca	1
Lespedeza virginica	1
Rosa sp.	1
Conyza canadensis	1
Eupatorium serotinum	1
Quercus borealis	1
Juniperus virginiana	1
Crataegus crus-galli	1
Phryma letostachya	1
Ribes curvatum	1
Lespedeza capitata	1

Sideroxylon lanugin	1
Fraxinus pennsylvan	1
Dichanthelium dichot	1
Chamaecrista fascic	1
Solidago radula	1
Viburnum rufidulum	1
Lespedeza repens	5
Baptisia leucophaea	1
Desmodium sp.	1
Tilia caroliniana	1
Chionanthus virginici	1
Vitis vulpina	1
Hypericum hypericoid	1
Acer rubrum	1
Toxicodendron radic	1
Vaccinium stamineu	1

Soil <10 cm

Densiometer 16, 26, 37 19,29

OUA2

15S 0360322 3826074

Crown diar # stems # stems w/ genets

6

Juniperus Quercusvelutina

3.6 22
 11

Ilex opaca	10
Pinus echin	1
Fagus grar	1
Vaccinium	25
Mitchella re	5
Polystichur	1
Smilax rotu	1
Smilax glau	1
Quercus ru	1
Gooyera pi	1
Vitis rotunc	1
Hamamelis	1
Carya alba	1
Maianthem	1
Prunus ser	1
Dioscorea	1
Carex late	1
Solidago ul	1
Cornus flor	1
Ostrya virg	1
Vitis vulpin	1
Pteridium a	1
Hypericum	1
Dichanthe	1
Rhododenc	1
Dichanthe	1
Muhlenber	1
Acer rubrui	1

Soil	<10.0 cm
Densiometer	2, 7, 6, 6, 1

OUA3

15S 0347606 3842085

Crown diar # stems # stems w/ genets

20 8

65 13

6 3

20 6

7 3

3

Acerrubrun	1
Caryatome	1
Vaccinium	50
Vaccinium	5
Vitisrotudin	1
Smilaxboni	1
Lespedeza	1
Schizachry	1
Solidagoun	1
Nyssasyva	1
Amelanchi	1
Smilaxrotu	1
Smilaxglau	1
Pinusechin	1
Sassafrase	1
Dichanthei	1
Dichanthei	1
Dichanthei	1
Robiniapse	1
Vaccinium	1
Aureolarias	1
Hypericum	1
Lespedeza	1
Quercusve	1
Danthonias	1
Ostryavirgi	1
Hamamelis	1
Vitisvulpina	1

Soil <10.0 cm
Densimeter 5,17,38,26,9

OUA4

15S 0347466 3842104

Crown diar # stems # stems w/ genets

30	7	
30	6	
6	2	
40	8	
12	3	
30	10	
40	21	
30	10	
40	21	
30	10	
30	9	1
50	14	
55	8	2
10	4	
5	3	
15	5	
10	4	
10	5	
22	8	
12	3	

Ovirginianæ	Pechinata	Fgrandifoliæ	Qalba	Pinusechin	Quercusve	Quercusalt	Nyssasylyæ	Quercusmæ	Sassafrasalbidum
				12.8	17.5	7.8	9.7	26.5	7.6
3	15.9	36.8	7.3	10.6	13.7		5.4	18.3	
2.7	34.4	48.4	18.3	22.4	31.5		10.6	15.8	
9.5	36.4	8.5	15.4	8	11.9		22.9	11.3	
10.4	27.2	22.5	16.1	20.5	12.5		16.1	9	
7.4	27.8	3	10.3	11	13.3		9.2		
6.3	23.9	10.2	7	9.2	14.4				
9.5	37	56.4	8.9	32.1	12.2				
9.4	30	8.7	14.2	19.8	12.1				
4.7	33.2	4.3	4.7	18.9	29.2				
4.4	35.4	4.8	12.7	14.4	18.6				
5.2	42.7	7.7	17	27.4	34				
3.5		2.6	4.6	19.4					
7		8.3	16.5	18.1					
		3.1	4.4	15.5					
		3.9	4.6	23.3					
		5.7	5.8	27.6					
		3.5	7.7	30					
		3.5	13.7	37.4					
		11.8	13.4	15.5					
		3.5	8	35.6					
		2.6	12.1	9.9					
		3.2	48	17.1					
		10.5	7.2	24.2					
		3.6	18.2	13.1					
		5.7	13.4	15.7					
		5.5	9.7	26.3					
		9.2	17.7	7.2					
		2.5	12.3	6.2					
		3.2	7.3	7.1					
		3.5	8.1	7.8					
		3.2	8.6	8.5					
		5.4	10.7	29.5					
		9.6	9.2	42.3					
		8.5	7.8						
		6	7.3						

Acerrubrun	1
Caryatome	1
Vacciniumj	70
Vacciniums	5
Prunusserc	1
Smilaxboni	1
Lespedeza	1
Schizachry	5
Tridensflav	1
Smilaxglau	1
Pinusechin	1
Sassafrase	1
Dichanthei	1
Vacciniums	1
Aureolarias	1
Danthonias	1

Soil <10.0 cm

Densimeter 23,33,42,88,38

OUA5

15S 0347431 3842153

Crown diar # stems # stems w/ genets

80 31

75 23

11 6

1 2

35 5

20 4

13 5

2

Ovirginianæ	Pechinata	Fgrandifoli:	Qalba	Pinusechin	Quercusve	Quercusal:	Nyssasyva	Quercusm:	Caryatomentosa
				21	36.1	2.8	12.1	7.6	8.2
3	15.9	36.8	7.3	27.9	32.9		10.6	8.7	
2.7	34.4	48.4	18.3	19.7	4.6		10.7	8.8	
9.5	36.4	8.5	15.4	28.7	42.9		10.1	15.2	
10.4	27.2	22.5	16.1	21.8			8.2	12	
7.4	27.8	3	10.3	20				12.5	
6.3	23.9	10.2	7	17.6				2.8	
9.5	37	56.4	8.9	29				17.9	
9.4	30	8.7	14.2	15.4				11.7	
4.7	33.2	4.3	4.7	14.1				14.7	
4.4	35.4	4.8	12.7	18				3.9	
5.2	42.7	7.7	17	17.5					
3.5		2.6	4.6	17.8					
7		8.3	16.5	21.6					
		3.1	4.4	6.5					
		3.9	4.6	7.4					
		5.7	5.8	15.7					
		3.5	7.7	14.1					
		3.5	13.7	11					
		11.8	13.4	13.1					
		3.5	8	15.7					
		2.6	12.1	14.3					
		3.2	48	39.4					
		10.5	7.2	6.2					
		3.6	18.2	24.3					
		5.7	13.4	20.1					
		5.5	9.7	15.6					
		9.2	17.7	19.7					
		2.5	12.3	20.9					
		3.2	7.3	22.8					
		3.5	8.1	33.6					
		3.2	8.6	29.8					
		5.4	10.7	20.9					
		9.6	9.2	19.5					
		8.5	7.8						
		6	7.3						

Acerrubrun	1
Caryatome	1
Vacciniumj	55
Vacciniums	1
Lespedeza	1
Schizachry	5
Tridensflav	1
Smilaxglau	1
Pinusechin	1
Sassafrasa	1
Dichanthei	10
Vacciniums	1
Danthonias	1
Tephrosiav	5
Rhus copa	1
Nyssasyve	1
Lespedeza	1
Solidagoulr	1
Robiniapse	1
Quercusm:	1
Quercusve	1
Pteridiuma	1

Soil	<10.0 cm
Densiometer	14, 21, 33, 59, 85

OUA6

15S 0347431 3842153

Crown diar # stems # stems w/ genets

45 6
3 3

1

Quercusst Acerrubrun Acersacch: Juniperusvirginiana

17.1	10.9	2.5	1
	3.4	2.7	
	2.7	2.6	
	2.5	3.9	
	7.1	2.5	
	2.5	3	
	3.9		

Acerrubrun	1
Vaccinium	10
Vaccinium	1
Schizachry	1
Dichanthe	1
Danthonia	1
Solidagou	1
Quercusve	1
Pteridium	1
Hypericum	1
Prunusserc	1
Acersacch	1
Galiumsp.	1
Cunilaoreg	1
Smilaxrotu	1
Asterpaten	1
Aureolariac	1
Ostryavirgi	1
Antennaria	1
Galiumsp.2	1
Toxicodenc	1
Parthenoci	1
Desmodiur	1
Fagusgran	1

Soil <10.0 cm

Densiometer 4, 0, 4, 5, 3

Appendix C: Original data sheets

Site

nila var. *ogarkinsis*

Location Oua 1

12/14

Observers AB, BHSJH

Point

Soil Depth

Densiometer Readings

Community Type

Associated species & % cover or DBH

Mockernuth.	9	Q. stellata	18.1	Vac. arboreum	4.2	Sassafras	10.6
"	8.9	"	12.5	Sassafras	6.5	Chionanthus	4.0
"	14.6	"	7.9	Vac. arboreum	4.3	"	2.7
"	10.4	"	13.5	"	3.3	Sassafras	3.1
"	14.9	N. red oak	5.6	"	3.1	"	6.1
"	18.3	Q. stellata	8.5	Sassafras	12.6	Sideroxylon l.	4.1
"	22.4	"	7.0	Vac. arboreum	3.3	Sassafras	5.0
"	6.9	"	9.0	"	4.7	Chionanthus	3.0
"	6.3	Mockernuth	12.3	"	3.2	Sassafras	4.0
"	6.4	"	12.5	"	5.5	"	4.7
"	14.7	"	10.4	"	3.2	Amur Maple	3.3
"	11.9	"	12.6	"	4.7	Sassafras	12.09
"	7.8	"	10.9	"	5.5	"	4.2
"	18.0	"	17.7	"	4.5	Q. stellata	16.3
"	10.9	"	14.2	"	6.0	"	41.3
"	11.4	"	7.2	"	4.2	Ostrya vir.	3.9
"	6.8	"	7.5	"	3.4	Q. stellata	17.1
"	12.8	"	10.8	"	3.6	Prunus serot.	24.8
"	10.1	"	9.6	"	2.7	Q. stellata	13.7
"	11.0	"	9.5	"	4.5	Prunus ser.	16.4
"	12.4	"	12.7	"	4.7		
"	12.5	"	6.8	"	3.7		
"	8.7	"	10.9	"	4.1		
"	7.4	"	6.3	"	3.7		
"	11.8			"	3.7		
"	14.4			"	5.9		
"	14.4			"	2.6		
"	14.2			"	4.0		
"	12.0			"	5.2		
"	12.9			"	5.0		
"	11.0						
"	17.8						
"	14.1						
"	20.9						

Site

Species Castanea pumila var. arkensis Location OUA 1
 Date 10/21/41 Observers AB, BH, SH
 Photo Point 292° Soil Depth <10cm
 Densimeter Readings 6, 26, 37, 19

Community Type

291
 Oak hickory forest with redoaks in decline
 associated species & % cover or DBH

<i>L. hirt</i>	1	<i>Cassia fasc.</i>	1				
<i>And. sp.</i>	1	<i>Solidago radula</i>	1				
<i>Aster patens</i>	1	<i>Viburnum rot.</i>	1				
<i>Solidago ulm.</i>	1	<i>Lesped. rezens</i>	5				
<i>Urtica mac.</i>	1	<i>Parth. leucopla.</i>	1				
<i>Rubus sp.</i>	10	<i>Desmodium</i>	1				
<i>Scleria sp.</i>	1	<i>Tilia Grol</i>	1				
<i>Jac. pallidum</i>	1	<i>Chimaphila</i>	1				
<i>Dian. linearif.</i>	5	<i>Vitis vulp.</i>	1				
<i>Parth. grac.</i>	1	<i>Hyp. hyp.</i>	1				
<i>Schiz. scop.</i>	1	<i>Acer rub.</i>	1				
<i>Hypericum prol.</i>	10	<i>Tox rad.</i>	1				
<i>Apt. plan.</i>	1	<i>Vacc. stam.</i>	1				
<i>Potent. simpl.</i>	1						
<i>Ruellia patillens</i>	1						
<i>Gallium s. k.</i>	1						
<i>Dianth. bassii</i>	1						
<i>Monarda russ.</i>	1						
<i>Fireweed</i>	1						
<i>Smilax glauca</i>	1						
<i>Lespedeza virg.</i>	1						
<i>Rosa sp</i>	1						
<i>Caryzad.</i>	1						
<i>Eupat. serot.</i>	1						
<i>Quercus bor</i>	1						
<i>Juniperus virg.</i>	1						
<i>Cant. corus-galli</i>	1						
<i>Phytol.</i>	1						
<i>Ribes cuneat.</i>	1						
<i>Lespedeza Cap.</i>	1						
<i>S. Barosylon</i>	1						
<i>Fray. Per</i>	1						
<i>Dianth. dichototbr</i>	1						

Population

Species Castanea pumila var. ozarkensis Observers AB, BH, SH
 Date 9/21/4 Plot Size 30x30
 Location out 1 % Cover in Plot _____

see below

#Stems _____ #In Fruit 1 #Immature _____
 #In Flower _____ #Mature _____ #Senescent _____

Overall Population Vigor

Small trees.

Disease or Predation?

Evidence of some herbivory on leaves. Evidence of blight.

Drawing of Plot:

[+ 1 individual 9.5
 + alive stems 6 (all less than 2.5cm)

→ crowd dia. 20cm

[1 individual < 2.5cm no crown
 1 sprout < 2.5cm

[5 < 2.5cm
 → 33cm crown diameter

[5cm - with buds!
 2.9cm
 3.0cm
 11 < 2.5cm
 → 67cm crown

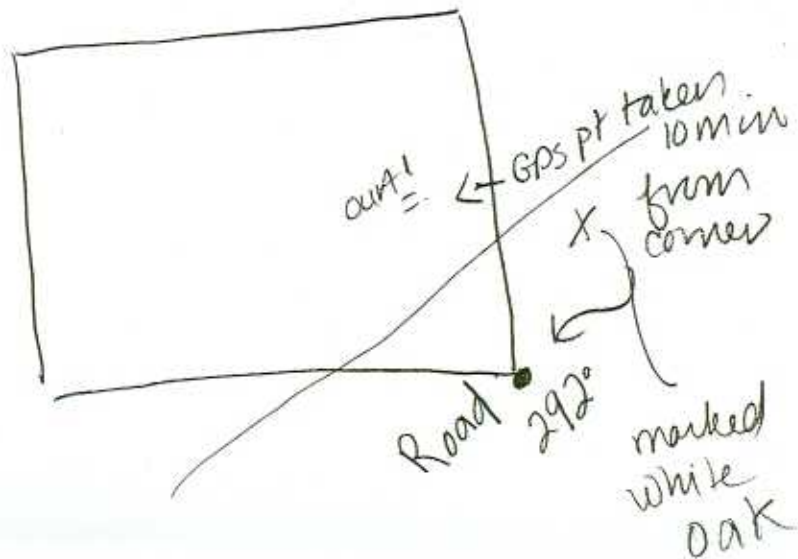
[2.6cm
 3.1
 4.1
 5.1
 27 < 2.5cm
 2.7
 → 105cm crown

[3.6cm
 12 < 2.5cm
 → 55cm crown

[3 individuals < 2.5cm
 → 15cm crown

[2.6
 6 < 2.5cm
 → 50cm crown

[2.9
 11 < 2.5cm
 → 23.0cm crown



Site

Species C. pumila var. arkensis Location OUA 2
 Date 8/10/5 Observers BH, AB
 Photo Point 104° E of N Soil Depth < 10 cm
 Densimeter Readings 2, 7, 6, 6, 1

Community Type Beech / white oak / red maple forest

Associated species & % cover or DBH

astyrq v.	3.0	Q. alba	7.3	Fagus g.	11.8	Hammamelis	virginiana
	2.7		18.3		3.5		2.5
	9.5		5.4		2.6		2.6
	10.4		16.1		3.2		2.5
	7.4		10.3		10.5		
	6.3		7.0		3.6		
	9.5		8.9		5.7		
	9.4		14.2		5.5		
	4.7		4.7		9.2		
	4.4		12.7		2.5		
	5.2		17.0		3.2	Q. alba	18.2 8.6,
	3.5		4.6		3.5	13.7	13.4 10.7, 9.2
	7.0		16.5		3.2	13.4	9.7
			4.4		5.4	8.0	17.7 7.8
			4.6		9.6	12.1	12.3 7.3
			5.8		8.5	48.0	7.3
			7.7		6.0	7.2	8.1
pinus ech.	23.9	Acer rubrum	3.8	Cornus f.	5.7	N. red oak	7.7
15.9	39.0		8.3	6.4	7.3		10.1
34.4	30.0		7.5		5.1		
36.4	33.2		9.2		3.4	Amelanchier	9.8
27.2	35.4		3.2		10.0		14.9
27.8	42.7		3.5		4.5		
Fagus g.	8.7		8.3		6.7		
36.8	4.3		4.1		2.8	S. red oak	16.3
48.4	4.8		2.5	Carya alba	4.9		9.0
8.5	7.7		4.6		6.7		
22.5	2.4		6.1				
3.0	8.3		6.3			Q. velutina	22.0
10.2	3.1		17.5	Max o.	4.4		11.0
56.4	3.9		8.0	6.9, 6.6	3.8		
	5.7		4.2	3.0	2.6	Juniperus v.	3.6
	3.5		7.4	Nyssa o.	4.0		
	3.5		4.0, 5.5		4.5		

Ilex Op. 10
 Pinus ach. 1
 Fagus 1
 Vacc. pallidum 25
 Mitchella 5
 Xmas Fern 1
 Smilax rot. 1
 Smilax laevis 1
 Q. rubra 1
 Goodyera 1
 Vitis rot. 1
 Ham. virg. 5
 Coryx alba 1
 Smilacina rac. 1
 Prunus ser. 1
 Dioscorea quat 1
 Carex lat. 1
 Solidago ulm. 1
 Cornus fl. 1
 Strya 1
 Vitis calp. 1

Pteridium 1
 Hypericum pro. 1
 Dicentra bosci 1
 Rhodo. 1
 Panicum linear. 1
 Muhl. Sobol. 1
 Acer sub. 1

Population

Species C. p. v. pumila

Observers BH, AB

Date 8/10/5

Plot Size 30x30

Location Qua 2

% Cover in Plot 25%

#Stems 0

#In Fruit 0

#Immature all

#In Flower 0

#Mature 0

#Senescent 0

Overall Population Vigor

Disease or Predation? yes, herbivory on leaves (insects)

Drawing of Plot:

densiometer

2, 7, 6, 6, 1

Acer rub. 1
Carya toment. 1
Vac. vac. 50
Vac. glau 5
Vitis rot. 1
Smil. bona 1
Lesped. stuu. 1
Schiz. scop. 1
Solid. ulm. 1
Nyssa syl. 1
Amel. abor. 1
Smil. rot. 1
Smil. glauc. 1
Pinus ech. 1
Sagssatress 1
Dianthe linear fol 1
" box 1
Parrotia dictat 1

Robinia pseud. 1
Vac. arb. 1
Aureolaria (sticky) 1
Hyp. hyp. 1
Lesped. procumb. 1
Quercus vel. 1
Diantheria spic. 1
Ostrya virg. 1
Hamamel. virginica 1
Vitis vulp. 1

lay
3240
clump

Population

Species Castanea pumila v. ozana Observers AB BH
Date 9/1/5 Plot Size 30x30
Location OUA3 % Cover in Plot <5%

#Stems 36 ^{see break down below} #In Fruit 0 #Immature all
#In Flower 0 #Mature 0 #Senescent 0

Overall Population Vigor larger stems w/ some signs of blight

Disease or Predation? herbivory - insects on leaves
green caterpillar (undent.) noticed

Drawing of Plot:

1 clump w/ 8 stems - crown 62cm
all 41.0 cm

1 seedling

1 clump w/ 13 stems - crown 65cm
4.9 cm, 7.3 cm, 3.7,

1 clump w/ 3 stems - crown 6cm

1 clump w/ 6 stems - crown 20cm

1 clump w/ 3 stems crown 7cm

1 seedling

1 seedling



Site

Species C.p. v. o.
 Date 7/1/15
 Photo Point 23, 33, 42, 88, 38
 Densimeter Readings ② 310

Location OUA 4
 Observers BH, AB
 Soil Depth < 10cm

Community Type Pine Woodland

Associated species & % cover or DBH

<i>Pinus muricata</i>	12.8	<i>Nyssa sylvatica</i>	9.7	<i>Q. velutina</i>	17.5	<i>Q. mailandica</i>	26.5
	10.0		5.4		13.7		18.3
	22.4		10.6		31.5		15.8
	8.0		22.9		11.9		11.3
	20.5		16.1		12.5		9.2
	11.0	↓	9.2		13.3		
	9.2				14.4		
	32.1				12.2		
	19.8				12.1	<i>Sassafras al.</i>	7.6
	18.9				29.2		
	14.1				18.6		
	27.4				34.0		
	19.4	<i>Pinus echinata</i>	8.4				
	18.1					<i>Quercus alba</i>	7.8
	15.5						
	23.3						
	27.6						
	30.0						
	37.4						
	15.5						
	35.6						
	9.9						
	17.1						
	24.2						
	13.1						
	15.7						
	26.3						
	9.2						
	12.2						
	7.1						
	7.8						
	9.5						
	29.5						
↓	42.3						

Vac. Vac.	70
Schiz. scop.	5
Lesped. stat.	1
Sassafras	1
Pinus ech.	1
Vac. Stam.	5
Vac. arb.	1
Pinus sp.	1
Amorpha (stark)	1
Acer rub.	1
Danthoxia spic	1
Tridens flav.	1
Carya tom.	1
Smilax glauc.	1
" bona	1
Dracopis linearif.	1

Population

Species C. p. v. 0
 Date 9/1/5
 Location QUA.4

Observers 1, 2, BH
 Plot Size 20x30
 % Cover in Plot 50%

#Stems _____ #In Fruit 3 #Immature _____
 #In Flower 0 #Mature 3 #Senescent 0

Overall Population Vigor Some evidence of blight (split stems),
in recent stems, death
 Disease or Predation? Herbivory evidence

Drawing of Plot:

- clump 7 stems 30 cm crown
- clump 6 stems 30 cm crown
- clump 2 stems 6 cm crown
- clump 3 stems 40 cm crown
- clump 3 stems 12 cm crown
- clump 10 stems 30 cm crown
- clump 40 cm crown
- clump 21 stems 30 cm crown
- clump 10 stems, incl. 2.7, 3.5 30 cm crown
- clump 9 stems, incl. 2.2 cm, 30 cm crown
- clump 2.6 (w/ buds), 3.0
- clump 14 stems, incl. 2.5, 2.5, 2.5, 2.6 50 cm crown
- clump 8 stems, incl. 4.5 (buds), 2.5 (buds), 2.6 55 cm crown
- clump 4 stems 10 cm
- clump 3 stems 5 cm

- 15 cm crown
- 10 cm crown
- 10 cm crown
- 22 cm crown
- 12 cm crown
- 5 stems
- 4 stems
- 5 stems
- 8 stems
- 3 stems



310°
Sna el Castania

Site

Species C.p.v.o.

Location OUA5

Date 9/1/5

Observers AB, BH

Photo Point 320°

Soil Depth <10cm

Densiometer Readings 14.33, 59.13 + 4.18,
21

Community Type Pine woodland

Associated species & % cover or DBH

<i>Pinus echinata</i>	21.0	<i>Nyssa sylv.</i>	12.1	<i>Quercus velutina</i>	36.1	<i>Quercus alba</i>	2.8
	27.9		10.6		32.9		
	19.7		10.7		4.6		
	28.7		10.1		42.9		
	21.8		8.2				
	20.0						
	17.6						
	29.0						
	15.4						
	14.1						
	18.0						
	17.5			<i>Q. maunlandica</i>	7.6	<i>Molkenmuth.</i>	8.2
	17.8	<i>Pinus echinata</i>	6.0		8.7		
	21.6		32.9		8.8		
	17.5		16.7		15.3		
	17.1		15.6		12.0		
	15.7		13.4		18.5		
	14.1		13.6		2.8		
	11.0		17.1		17.9		
	13.1		14.8		11.7		
	15.7		14.8		19.7		
	14.3		21.6		3.9		
	39.14						
	6.2						
	24.3						
	20.1						
	15.6						
	19.7						
	20.9						
	22.8						
	33.6						
	29.8						
	20.9						
	19.5						

18.5 / 17.3 / 14

Population

Species C. p. v. o.
 Date 9/1/5
 Location QUAS

Observers BH, AB
 Plot Size 30X30
 % Cover in Plot 50%

#Stems _____
 #In Flower 0

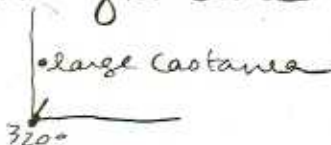
#In Fruit 0
 #Mature 0

#Immature _____
 #Senescent 0

Overall Population Vigor Evidence of blight (split stems)

Disease or Predation? Herbivory evidence

Drawing of Plot:



clump - 31 stems, 80cm crown
 incl. 3cm, 2.5cm, 2.5cm, 2.6cm

clump - 23 stems 75cm crown - also dead trunk
 incl. 2.5 of 10.8 cm

clump 6 stems 11cm crown

1 seedling

clump 2 stems 1cm crown

clump 16 stems 35cm crown

clump 4 stems 4cm crown

clump 5 stems 35cm crown

clump 4 stems incl. 2.7cm 20cm crown dead trunk
 7.2

1 seedling (2cm)

clump 5 stems 13cm

Mac arb . 10

Sch. 2 scop. 5

Tephrosia vicia 1

Uac uac 55

Lesp. stuv. 1

Blume scop. 5

Nyss. syl. 1

Aspid. ... 1

Cary. ... 1

Ficus ech. 1

Smilax glauca. 1

Danthan spicata 1

Solidago ulmif. 1

Robinia pseud. 1

Sassafras 1

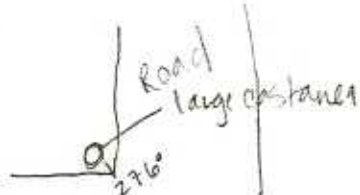
Acer rubrum 1

Quercus marit. 1

Vel. 1

Platanus aquil. 1

Uac. stercor. 1



Site

Species C.p.v.i.o

Location OUAL

Date 9/2/5

Observers BH, AB

Photo Point 276°

Soil Depth <10 cm

Densimeter Readings 4, 5, 3

4)

Community Type

Associated species & % cover or DBH

5.1	<i>Nyssa syl.</i>	4.4	<i>Fagus grand.</i>	3.7	<i>Q. alba</i>	16.2	<i>Pinus resin.</i>	33.0
38.0		3.1		3.3	18.9	22.9		36.0
28.5		2.5		2.9	20.9	30.8		24.5
		2.7		4.0		8.9		29.1
		24.7		3.2		14.4		10.8
		13.8		4.2		24.5		18.8
		3.0		3.0		10.2		34.0
		3.1		3.0		6.3		37.7
		24.4		2.9		4.5		20.1
		5.4		4.4		63.7		8.9
30.16	<i>Q. velutina</i>	19.0		2.5		4.0		40.1
26.1		23.6		4.8	<i>Pinus resinata</i>	30.5		29.4
		30.2		4.8		35.6		33.6
		12.5				29.0		17.8
		12.5	<i>Ostrya virgin.</i>	3.0		34.7	<i>Cornus florida</i>	3.2
		23.5		4.2			<i>Q. stellata</i>	17.1
10.0	<i>Amel. arb.</i>	3.7		3.1			<i>Acer rubrum</i>	5.5
5.8	<i>Amel. arbor.</i>	5.3		2.5				9.1
		11.0		3.4				12.1
		4.0		2.8				
	<i>Amel. arbor.</i>	2.5		5.0				
		2.5		2.5			<i>Acer rubrum</i>	10.9
		2.5		2.6			<i>Acer rubrum</i>	3.4
		11.5		4.7	<i>Mockernut h.</i>	6.9		2.7
		7.5		2.6		16.4		2.5
		8.3		4.7		6.8		7.1
	<i>Ostrya v. v.</i>	3.2		2.5		8.1		2.5
		3.1		2.5		12.4		3.9
		3.8		3.2		7.7	<i>Acer parcarum</i>	2.5
		2.5		8.0		18.1	2.7	2.6
		3.5		4.0		14.6		3.9
		5.0		7.9		2.7		2.5
		3.0		4.1				3.0
		2.9					<i>Juniperus virgin.</i>	10.5

Population

Species C.p.v.o.
Date 9/2/5
Location OUA 6

Observers BH, AB
Plot Size 30x30
% Cover in Plot < 5%

#Stems 6
#In Flower 0

#In Fruit 0
#Mature 0

#Immature 0
#Senescent 0

Overall Population Vigor Blight on large stem

Disease or Predation? Herbivory (insects)

Drawing of Plot:

clump

6 stems, inc. crown 45 - large stem
21.7cm, 2.5, 2.5, 'center' still standing
2.7

clump

3 stems

crown 3cm

1 individual

Hyp. hyp 1

Prunus ser. 1

Acer rub 1

Acer sac 1

Quercus vel 1

Vacc. lac 10

Vacc. str. 1

Galium 1

Scribosa ulmif. 1

curila or. 1

Smilax rot. 1

Dianthia spic. 1

Aster pat. 1

Dicanth. linearif. 1

Pteridium aquil 1

Aureolaria grandifl. 1

Schiz. scop. 1

Ostrya 1

Ant. plant. 1

Galium (long ped) 1

Tox. rad. 1

Parth. quin. 1

Desmod sp. 1

Fagus 1

Hyp. hyp 1

Prunus ser. 1

Acer rub 1

Acer sac 1

Quercus vel 1

Dac. lac 10

Dac. st. 1

Celastrus

Schreb. albif. 1

Cunila or. 1

Smilax rot. 1

Danthonia spic. 1

Aster pat. 1

Dicanth. linearif. 1

Pteridium aquil 1

Aureolana grandifl. 1

Schiz. scop. 1

Ostrya 1

Ant. plant. 1

Celastrus (long ped) 1

Tox. rad 1

Parth. quin 1

Desmod sp 1

Fagus 1