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Conservation Assessment
for
Prairie-Dock (*Silphium pinnatifidum* Elliott)



USDA Forest Service, Eastern Region

October 1, 2004

Shawnee National Forest
Hoosier National Forest

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Technical Report 2005(3)

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

The National Forest Management Act and U. S. Forest Service policy require that Forest Service lands be managed to maintain viable populations of all native plant and animal species. A viable population is one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its range within a given planning area (FSM 2670.5.22).

In addition to the above mandate the Forest Service has to protect species listed as endangered or threatened under the Endangered Species Act (ESA), species of Concern by U.S. Fish and Wildlife Service, and species designated as Regional Forester's Sensitive Species (RFSS) based on Global/National ranks and/or risk evaluation. The Eastern Region of the Forest Service (R9) updated its Sensitive Species list on February 29, 2000 (list maintained as of October 20, 2003). Part of that process included identification of priority species for further study by the development of Conservation Assessments and Strategies.

Silphium pinnatifidum, one of these RFSS, occurs within the proclamation boundaries of the Eastern Region (R9) National Forests, which includes 20 states and 15 National Forests. The states included are Connecticut, Delaware, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin. The National Forests included are the Allegheny, Chequamegon/Nicolet, Chippewa, Green Mountain/Finger Lakes, Hiawatha, Hoosier, Huron-Manistee, Mark Twain, Midewin (National Tallgrass Prairie), Monongahela, Ottawa, Shawnee, Superior, Wayne, and White Mountain. This conservation assessment will concentrate on these states and National Forests, but particular emphasis will be given to Illinois and Indiana where the Shawnee and Hoosier National Forests are found.

The main objective of this conservation assessment is to present information on the taxonomy, life history, habitat, distribution, global and national status, population viability, and potential threats for *Silphium pinnatifidum*. All the information presented here is the result of literature searches and reviews, examination of herbarium specimens, and personal and written communication with botanists from universities, herbaria, and state/federal agencies. The ultimate goal of this conservation assessment is to provide the available background information needed to prepare a subsequent conservation strategy for *Silphium pinnatifidum*.

ACKNOWLEDGEMENTS

I would like to thank Steve Hill for his advice in the preparation of this document and for providing contact information, John Taft for gathering the Shawnee National Forest Herbarium data, and Mary Ann Feist, John Taft, and Laura Roberts for editorial comments. Also, I want to thank the State Natural Heritage and Forest Service biologists for species information.

I would like to give special thanks to all the herbarium curators (see list of contact people) for the information that they provided about the species. Without their contributions, this report would be lacking a lot of habitat and state distribution information. Their contributions to this report should be a reminder of why herbaria should be supported.

Finally, many photos and maps have been used in this report to describe the species and to provide species distribution information, among other things. Web pages have been cited at the end of the report to acknowledge their use and the name of the photographers.

NOMENCLATURE AND TAXONOMY

Family: Asteraceae

Scientific name: *Silphium pinnatifidum* Elliott

Varieties: none

Common names: Prairie-Dock; Tansy rosinweed (TN, KN), Southern Prairie-dock (TN), Rosinweed (IL), Cutleaf Rosinweed (GA)

Synonymy: *Silphium terebinthinaceum* Jacq. var. *pinnatifidum* (Ell.) Gray, *Silphium chickamaugense* Canby (Kartesz 1994)

USDA Plants code: SIPI2

The genus *Silphium* L., commonly known as rosinweed, is in the Asteraceae within the tribe Heliantheae and subtribe Engelmanniinae. This genus is easily recognized by its perennial habit, large flower heads with yellow ray and disc flowers. The sterile disc flowers have undivided stigmas. The achenes are flattened seeds.

The type specimen of this species can be found in the United States National Herbarium in Washington DC. *Silphium pinnatifidum* Elliott, S., Sketch Bot. S. Carolina, 2:462. 1824 - Isonotype (Asteraceae) COLLECTION: Small, J.K. s.n., 06 Aug 1895 to 12 Aug 1895. USA. Georgia. Catoosa. Chickamauga Creek, near Ringgold. COLLECTION REMARKS: Specimen annotated by J.A. Clevinger in 1999 as an isonotype. To be neotypified in Syst. Monogr. CURRENT PLACEMENT: *Silphium terebinthinaceum* var. *pinnatifidum* (Elliott) A. Gray (Asteraceae). VERIFICATION: Place of publication unknown. US SHEET NO.: 00298705 BAR CODE: 00623576, from Department of Systematic Biology - Botany, Smithsonian Institution.

Hybridization issues have hampered a full understanding of the taxonomy of this species. Fisher (1959) and Fisher and Speer (1978) suggested that *Silphium pinnatifidum* was a stable hybrid between *S. laciniatum* and *S. terebinthinaceum*. The leaves of *Silphium pinnatifidum* resemble *S. laciniatum* in their lobed nature. Allison and Stevens (2001) have observed hybrids when both of these species grow in close proximity. Current phylogenetic work by Clevinger and Panero (2000) supports that *S. pinnatifidum* is more closely related to *S. terebinthinaceum* than *S. laciniatum*. However, Clevinger and Panero (2000) pointed out that to determine if hybridization has been involved in the evolution of *Silphium pinnatifidum* sampling of chloroplast markers should be done to make comparisons between the species and varieties. Clevinger (pers. comm.; unpubl. document) is going to be treating *Silphium pinnatifidum* as a variety of *Silphium terebinthinaceum* in the Flora of North America (i.e., *Silphium terebinthinaceum* var. *pinnatifidum*). Finally, it should be noted that many herbaria could have specimens of *Silphium pinnatifidum* labeled as *Silphium laciniatum* X *Silphium terebinthinaceum*. For example, this is the way that *Silphium pinnatifidum* has been listed in the Wisconsin State

Herbarium database (W1). This should not be considered an oversight, since these specimens may be true first generation hybrids between *Silphium laciniatum* and *Silphium terebinthinaceum*. However, when available, specimen information labeled as *Silphium laciniatum* X *Silphium terebinthinaceum* has been included in this report.

DESCRIPTION OF SPECIES



Silphium pinnatifidum is a perennial tap-rooted plant that can be from 0.6 to 3 m tall in bloom (Carmon 2001; J. A. Clevinger (pers. comm.; unpubl. document).



Leaves are arranged in a basal rosette. The basal leaves are persistent and petiolate and can reach 8 dm long and 3 dm wide (Barnes and Francis 2004). Cauline leaves are alternate, petiolate or sessile. The leaf blade is pinnately lobed with up to 13 (or sometimes more) lobes. The lobes can have sinuses that are shallow or deep, sometimes extending nearly to the central vein. The leaf margins can be toothed or entire (0-90 teeth). The upper surface of the leaves is nearly glabrous, the under surface slightly scabrous, with a few short hispid hairs (Elliott 1971).



Each basal rosette will produce flowering stalks that are nearly leafless and smooth. The flowering stalks branch into several to many naked peduncles bearing the inflorescences. The inflorescences are 5-10 cm wide with yellow disk florets

and 13-20 yellow ray florets. The disk florets are sterile and the ray florets are fertile forming achenes (Gleason and Cronquist 1991). This species blooms from mid-summer to early fall (i.e., July to September).

Silphium pinnatifidum may be confused with *Silphium laciniatum* (Compass plant) when not in bloom because of the deeply pinnatifid or bipinnatifid leaves. However, *Silphium laciniatum* is very hairy and the flowering stalk has few progressively smaller alternate leaves along its length (Ladd and Oberle 1995). Also, inflorescences of *Silphium laciniatum* are larger, have dark (not yellow) centers, and do not have as many ray flowers (Barnes and Francis 2004).

LIFE HISTORY

Research has been conducted on the reproductive biology, ecology, and seed dispersal of other *Silphium* spp. such as *S. laciniatum*, *S. perfoliatum*, and *S. terebinthinaceum*. However, limited to no information is available regarding the reproduction biology, ecology, and dispersal of *Silphium pinnatifidum*. In general, as with many Asteraceae, this species can be self-incompatible (Mani and Saravanan 1999, Richards 1997). *Silphium pinnatifidum* flowers, as with other *Silphium* spp., are likely visited by a wide variety of pollinators (W2, see Appendix 1) that collect and feed on pollen or nectar.

Because *Silphium pinnatifidum* produces achenes, most likely, they will fall and stay under the maternal plant due to the lack of wind-dispersal structures associated with the achenes. This is supported by a study conducted on *Silphium laciniatum* (Compass plant), a very similar species, which found that distance between seedlings and the nearest flowering stem was about 1.0 m (Pleasants and Jurik 1992).

Seed germination may be easy, since other *Silphium* spp. (*S. laciniatum*, *S. integrifolium*, and *S. perfoliatum*) have been germinated without problems, though these *Silphium* spp. require stratification (33-38°F, 30-60 days; Shirley 1994). Seedling survivorship is unknown for *Silphium pinnatifidum*; however, Pleasants and Jurik (1992), based on total seed production for *Silphium laciniatum*, estimated that about 1% of seeds became seedlings in each year and that plants with multiple inflorescences had a significantly higher density of seedlings around them.

HABITAT

This species can be found in wet or dry prairies, fens, and disturbed sites kept free of underbrush (J. A. Clevinger pers. comm.; unpubl. document). In Wisconsin, *Silphium pinnatifidum* (i.e., *Silphium laciniatum* L. X *Silphium terebinthinaceum* Jacq.) was found in Scuppernong Prairie West (Waukesha County 2000; Wisconsin State Herbarium database (W1). This is a wet-mesic prairie, with patches of prairies, fens, sedge meadows, and wet thickets. *Silphium pinnatifidum* was found associated with *Spartina pectinata*. In Georgia, *Silphium pinnatifidum* has been found in limestone glades, barrens, along roadsides, and open deciduous woods on hillsides (W3; Kelly A. Bettinger, Collections Manager Herbarium, The University of Georgia, pers. comm.).

From specimens at the United States National Herbarium in Washington DC (as of January 2004) and Barnes and Francis (2004) *Silphium pinnatifidum* has been found growing along grassy roads, prairie patches and glades in Kentucky (within the Mississippian Plateau, Shawnee Hills, and Jackson Purchase). In Alabama, from herbarium specimens, *Silphium pinnatifidum* has been collected along roadsides, in a semi-disturbed prairie-like area, and in a calcareous woodland (United States National Herbarium in Washington DC [as of January 2004], Steve Ginzburg, Assistant Curator, University of Alabama Herbarium, pers. comm.).

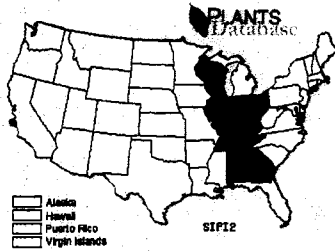
In Tennessee, *Silphium pinnatifidum* can be found along roadsides and in prairies, limestone cedar glades, and barrens (within the Eastern Highland Rim, Central Basin, Cumberland Plateau, Western Highland Rim, Ridge and Valley, Appendix 2) (Carmon 2001, Kirstin Condict, Data Manager, Tennessee Department of Environment and Conservation, Division of Natural Heritage, pers. comm.). *Silphium pinnatifidum* can be associated with the following species: *Gentiana puberlenta*, *Dalea foliosa*, *Helianthis occidentalis*, *Echinacea simulata*, *Liatris cylindracea*, *Schizachyrium scoparium*, *Echinacea tennesseensis*, and *Dalea candida*.

In Illinois and at the Shawnee National Forest, according to herbarium records, this species can be found in dry woodlands with intermingled limestone and sandstone barrens. Barrens are characterized by species of canopy trees tolerant of xeric conditions that have a stunted open-growth appearance, and the dominance of native warm-season grasses and prairie forbs (Olson 2002).



In Lake County, Indiana *Silphium pinnatifidum* was collected in a narrow strip of prairie (herbarium specimen collected by K. A. Board, September 22, 1996; Morton Arboretum Herbarium). This species was found growing with *Andropogon gerardi*, *Schizachyrium scoparium*, *Asclepias sullivantii*, *Asclepias syriaca*, *Aster laevis*, *Cornus racemosa*, *Daucus carota*, *Liatris spicata*, *Panicum virgatum*, *Populus deltoides*, *Silphium terebinthinaceum*, *Solidago altissima*, *Solidago rigida*, and *Sorghastrum nutans*.

DISTRIBUTION AND ABUNDANCE



Silphium pinnatifidum has been reported in Alabama, Illinois, Indiana, Georgia, Kentucky, Ohio, Tennessee, and Wisconsin (NatureServe Explorer 2004; USDA-NRCS 2004). Appendix 3 shows the county distributions for Georgia, Kentucky, Tennessee, and Wisconsin.

In Ohio, this species (= *Silphium terebinthinaceum* var. *pinnatifidum*, since Fisher [1988] does not recognize *S. pinnatifidum*) is found in western Ohio (Greg Schneider, Manager, Ohio Natural Heritage Program, pers. comm.). A specimen was collected in Wyandot County for phylogenetic analysis (Clevinger and Panero 2000) and it can be found at the University of Texas Plant Resource Center (voucher specimen Clevinger 349). However, in the Seventh Catalog of the Vascular Plants of Ohio (Cooperrider et al. 2001) *Silphium pinnatifidum* has been deleted from the known Ohio Flora since specimens have not been found to support the inclusion of the species. However, Cooperrider et al. (2001) do recognize *Silphium laciniatum* L. X *Silphium terebinthinaceum* Jacq.

In Wisconsin, the species was found in Waukesha County (2000); however, the Wisconsin State Herbarium database does not report this species as *Silphium pinnatifidum* but as *Silphium laciniatum* L. X *Silphium terebinthinaceum* Jacq. (W1). Ted Cochran (Wisconsin State Herbarium, pers. comm.) pointed out that the hybrids are extremely rare in Wisconsin even though the parents can be locally abundant and do grow together. Also, it should be noted that J. A. Clevinger (pers. comm.; unpubl. document) listed the species to be found in Michigan, but Voss (1996) in Michigan Flora did not list the species as present in the state.

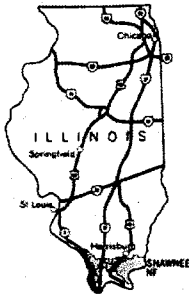
In Alabama, this species has been collected in Franklin (1940), Perry (2002) and Etowah counties (2002) (Steve Ginzburg, Assistant Curator, University of Alabama Herbarium, pers. comm., United States National Herbarium in Washington DC [as of January 2004]). In Georgia, *Silphium pinnatifidum* has been reported from the western counties (Elliott 1971) and, according to herbarium records, this species has been collected in two counties Catoosa (1948-1951; 1990-1991) and Walker (1899, 1900, 1917, 1947-1984) (Kelly A. Bettinger, Collections Manager Herbarium, The University of Georgia, pers. comm., United States National Herbarium in Washington DC [as of January 2004]). In Kentucky, two specimens were collected in Logan County (1940) and in Mammoth Cave National Park (1947) (United States National Herbarium in Washington DC [as of January 2004]).

The Division of Natural Heritage in Tennessee has 12 element occurrences (EO) for *Silphium pinnatifidum*. This species has been collected in Bradley (1 EO, 1983), Coffee (1

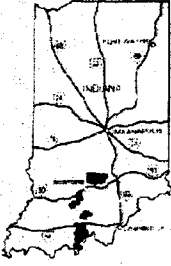
EO, 2004), Franklin (1 EO, 2004), Montgomery (3 EO, 1994), Rutherford (5 EO, 1993-2003), and Wilson (1 EO, 1998) (Kirstin Condict, Data Manager, Tennessee Department of Environment and Conservation, Division of Natural Heritage, pers. comm.). At the Illinois Natural History Survey Herbarium (as of June 2003) four records from Rutherford County collected in 1995 and 1998 can be found.



In Illinois, *Silphium pinnatifidum* has been reported in Hardin County, southeastern IL, (Anonymous 2001, Shimp 2001, Anonymous 2003) in a barren. John E. Schwegman (retired IL state botanist, pers. comm.) has seen a specimen (i.e., leaf) attributed to this species from a limestone glade in Hardin County. He mentioned that it looked like a deeply dissected leaf of *S. terebinthinaceum* but was more elongate than leaves of that species. However, he will not confirm the identification unless a complete specimen is available. The Illinois Natural History Survey Herbarium (as of June 2003) and the Southern Illinois University Herbarium do not have any records for *Silphium pinnatifidum* in Illinois (Michael Mibb, Assistant Curator, pers. comm.). Also, no elements of occurrences have been reported to the Illinois Natural Heritage Program. The United States National Herbarium in Washington DC (as of January 2004) has a specimen that was collected by E.S. Steele in the vicinity of Urbana, Champaign County in August 11, 1910.



Several specimens of *Silphium pinnatifidum* have been found in the Shawnee National Forest. Jody Shimp (ILDNR Natural Heritage biologist pers. comm.) mentioned that Larry Stritch (botanist – Forest Service) found a specimen at the Shawnee National Forest - Keeling Hill Forest Service Natural Areas in Hardin County. Also, at the Shawnee National Forest herbarium one specimen collected in 1991 by L.R. Stritch, E.L. Shimp, and J.P. Shimp is available (i.e., Elizabethtown Ranger District, Compartment 53). However, in 1997 Mark A. Basinger annotated the specimen as potentially being a hybrid between *S. laciniatum* and *S. terebinthinaceum*.



In Indiana, Kay Yatskievych and Kirk W. Larson (pers. comms.) pointed out that *Silphium pinnatifidum* does not occur in the Hoosier National Forest, but possibly does occur in Indiana. Deam et al. (1948) recorded this species as *Silphium terebinthinaceum* var. *pinnatifidum* from Pulaski County in northern Indiana. Kay Yatskievych (pers. comm.) mentions that specimens can be found at Friesner Herbarium and Deam Herbarium. This was confirmed at the Deam Herbarium (Indiana University, Eric Knox, Curator pers. comm.); however, at the Friesner Herbarium only specimens of *S. terebinthinaceum* were listed (Butler University, Indiana, Rebecca Dolan Director pers. comm.). The Morton Arboretum Herbarium has a specimen collected in a narrow strip of prairie in Lake County, Indiana (by Keith Board; September 22, 1996). The label reported that a few more plants were seen in the Cressmoor Prairie Nature Preserve. The Indiana Natural Heritage Data Center has no elements of occurrence for *Silphium pinnatifidum* (Ronald P. Hellmich, pers. comm., Indiana Natural Heritage Data Center).

RANGE WIDE STATUS

Global Heritage Status: G3Q as of August 11, 2000, due to being fairly uncommon but not severely threatened (NatureServe Explorer 2004). In general, a G3 classification means that the species is vulnerable and at moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors. In addition, *Silphium pinnatifidum* was also classified as Q meaning questionable taxonomy (i.e., taxonomic distinctiveness of this entity at the current level is questionable). Once this issue is resolved this species can be changed to a subspecies or hybrid, or be included within another taxon, with the resulting taxon having a lower conservation priority. It should be noted that J. A. Clevinger (pers. comm.; unpubl. document) is going to be treating *Silphium pinnatifidum* as a variety of *Silphium terebinthinaceum* in the Flora of North America (i.e., *Silphium terebinthinaceum* var. *pinnatifidum*).

National Heritage Status: N3 (as of August 11, 2000) meaning vulnerable to extirpation or extinction (NatureServe Explorer 2004).

National Forest Status: The Eastern Region of the Forest Service (R9) updated its Sensitive Species list on February 29, 2000 (list maintained as of October 20, 2003). According to this list *Silphium pinnatifidum* at the Shawnee National Forest has been designated a *R species meaning that risk evaluation is needed due to rank change. However, *Silphium pinnatifidum* is not considered a Regional Forester's Sensitive species at the Hoosier National Forest or any other National Forest within this region.

State Status: Alabama (SNR), Georgia (S3), Indiana (SNR), Kentucky (S3), and Tennessee (S2). For Illinois, Michigan, Ohio, and Wisconsin no information is available regarding the status of this species. In Ohio, the Natural Heritage Program does not have data on the species since it is not considered rare (Greg Schneider, Manager, Ohio Natural Heritage Program, pers. comm.). (NatureServe Explorer 2004; SNR - *Unranked*: State conservation status not yet assessed. S2 - *Imperiled*: 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. S3 - *Vulnerable*: 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.).

POPULATION BIOLOGY AND VIABILITY

Based on the global and state status (see above), few populations have been reported. According to herbarium records and personal communications, populations from one to several individuals have been observed. In addition, the general concern is that these populations are vulnerable since they seem to be declining. However, it should be noted that from elements of occurrences in Tennessee, several to hundreds of plants have been reported during the 1990's and 2000's (Kirstin Condict, Data Manager, Tennessee Department of Environment and Conservation, Division of Natural Heritage, pers. comm.). The potential threats listed under the next section can have a negative impact on the structure and viability of *Silphium pinnatifidum* populations, since most of them can lead to reduction in population size or plant recruitment.

POTENTIAL THREATS

The primary threats to *Silphium pinnatifidum* include fire suppression and succession of woody vegetation into open habitats, conversion of remnant prairies and barrens for development, herbicide use on roadsides, invasion by exotic plant species, loss of habitat due to quarries for limestone, and mowing (Kirstin Condict, Data Manager, Tennessee Department of Environment and Conservation, Division of Natural Heritage, pers. comm.; NatureServe Explorer 2004). In the case of the Shawnee National Forest, evaluation of their management prescription will be able to address the fire suppression issue including woody encroachment. For example, ecological restoration projects proposed for the Keeling Hill Forest Service Natural Areas, where the species has been reported, are to include controlled burning and selective tree and shrub removal (The Shawnee Quarterly 1999 [i.e., W4]). However, no date has been set for a decision on these projects.

Another potential threat associated with *Silphium pinnatifidum* is gall-insect attacks since research conducted on other *Silphium* spp. have shown negative impacts. Fay and Hartnett (1991) and Fay et al. (1996) reported that galled shoots of *S. integrifolium* had reduced shoot growth, leaf and flower head production, and delayed flowering compared to gall-free control shoots, but individual flower head weight, number of achenes per flower head or achene weight was not reduced. If plants have a high proportion of galled

shoots their response will be to have lower total biomass, a lower proportion of total biomass allocated to flower heads, higher allocation to leaves, but no change in allocation to stems or rhizome.

In addition, as with most species of *Silphium*, *Silphium pinnatifidum* has the potential of hybridizing with related species. These hybridization events can result in a hybrid zone, hybrid swarm, and a hybrid taxon. All of them have the potential of stressing the genetic integrity or viability of *Silphium pinnatifidum* populations. In addition, it is not clear if *Silphium pinnatifidum* is a stable hybrid or not. For example, in Wisconsin, hybrids (*S. laciniatum* X. *S. terebinthinaceum*) are extremely rare, even though the parents can be locally abundant and do grow together (Ted Cochrane Wisconsin State Herbarium, pers. comm.). Issues associated with how often crosses between parental plants and offspring occur, how viable and variable the offspring are, and how frequently the offspring breed among themselves, make addressing the classification of *Silphium pinnatifidum* difficult. Ted Cochrane (Wisconsin State Herbarium, pers. comm.) pointed out that it is difficult for him to envision these hybrids forming a subpopulation, and then developing new gene combinations with a new type of adaptive value, given their low frequency and the stability of the prairie habitat before 180 years ago.

RESEARCH AND MONITORING

Botanists from the Shawnee National Forest are actively looking for populations of *Silphium pinnatifidum*, since Forest Service policy dictates that forest areas proposed for any type of management activity are first inventoried (ground or map surveys of known occurrences) to determine if and how the habitat for this species may be affected (Shimp 2001). Systematic inventories are needed to determine new locations for this species across its range. In Ohio, these inventories are needed since conflicting data are available regarding the occurrence of the species in the state (Cooperrider et al. 2001). As with many threatened, endangered, and sensitive species no known monitoring programs are currently taking place. A long-term monitoring program must be developed to be able to determine demographics and population size.

Research to gather information on natural history, reproductive biology, genetic diversity, and the impact that management techniques may have on the species are needed. One particular research question that should be addressed associated with *Silphium pinnatifidum* is the taxonomy of the species. As previously noted J. A. Clevinger (pers. comm.; unpubl. document) is going to be treating *Silphium pinnatifidum* as a variety of *Silphium terebinthinaceum* in the Flora of North America (i.e., *Silphium terebinthinaceum* var. *pinnatifidum*). However, Clevinger and Panero (2000) have suggested that additional research should be done to determine if hybridization has been involved in the evolution of *Silphium pinnatifidum*. Sampling of chloroplast markers should be done between the species and varieties.

In addition, research should be conducted to determine if *Silphium pinnatifidum* is attacked by gall-insects and how this attack can affect seed production, since this has been shown in other *Silphium* spp. Also, it will be interesting to determine if this

Silphium species has an endophytic insect community as has been shown with *S. laciniatum* and *S. terebinthinaceum* (Tooker and Hanks 2004a,b). All this information is needed to develop the best conservation and management strategies.

SUMMARY

Silphium pinnatifidum is a perennial plant that can be found in Alabama, Indiana, Georgia, Kentucky, and Tennessee, and potentially in Illinois, Michigan, Ohio, and Wisconsin. The species can be found in wet or dry prairies, fens, disturbed sites kept free of underbrush, limestone glades, barrens, grassy roads, prairie patches, and calcareous woods. Across its range *Silphium pinnatifidum* is imperiled to vulnerable. *Silphium pinnatifidum* has been designated as a *R species meaning that risk evaluation is needed due to rank change at the Shawnee National Forest. Habitat loss due to habitat changes (woody encroachment, invasion of exotic species, and development), mowing, and insect attack can be potential threats for this species.

Identification of herbarium specimens and available data on *Silphium pinnatifidum* may be confounded by the hybrid origin of this species. Several herbaria have specimens labeled as *Silphium laciniatum* X *Silphium terebinthinaceum*, which potentially could be *Silphium pinnatifidum*. This should not be considered an oversight, since these specimens may be true first generation hybrids between *Silphium laciniatum* and *Silphium terebinthinaceum*.

Overall, due to insufficient data on several aspects of the species biology, it is very difficult to assess the effects that environmental, demographic, and genetic stochasticity, natural catastrophes, and anthropogenic activities may have upon *Silphium pinnatifidum*. Searches for new populations and research on life history, habitat requirements, stability of hybrids, and threats should be conducted. All of this information is needed if the best conservation and management strategies are desired for this species in National Forest lands.

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Gallatin, Hardin, Pope, Saline, and Union counties for the Environmental Assessment of commercial equestrian outfitter and guide permitting. Shawnee National Forest Document, 35pp.

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W2- Insect Visitors of Prairie Wildflowers in Illinois: <http://www.shout.net/~jhilty/>

W3- Georgia Natural Heritage Program
<http://georgiawildlife.dnr.state.ga.us/content/watchedplants.asp>

W- 4 The Shawnee Quarterly: The Shawnee National Forest Schedule of Projects
Issue No. 28 November 1999- <http://www.fs.fed.us/r9/shawnee/q28.html>

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Illinois Natural Heritage Database
Illinois Department of Natural Resources
ORC - Division of Habitat Resources
One Natural Resources Way
Springfield, IL 62702
Email: inhd@dnrmail.state.il.us

Indiana Natural Heritage Data Center
Ronald Hellmich
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402 W. Washington St., Rm W267
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Fax # 317-233-0133

Online Databases Consulted

Morton Arboretum Herbarium- vPlants web page: <http://www.vplants.org/>.
4100 Illinois Route 53
Lisle, IL 60532-1293
Tel: 630-968-0074
Email: trees@mortonarb.org

Wisconsin State Herbarium database- <http://www.botany.wisc.edu/herbarium/>

Herbaria visited

Illinois Natural History Survey Herbarium
Illinois Natural History Survey
Room 396
607 E Peabody Dr.
Champaign, IL 61820

United States National Herbarium
Department of Botany
Smithsonian Institution
P.O. Box 37012

Washington, DC 20013-7012

Photos

Cover page (same as pages 6 and 7) taken from TENN Vascular Plants – Database. Dr. B. Eugene Wofford, herbarium director (Email - bewofford@utk.edu) granted permission to use the image.

Page 6 Paul L Redfearn Jr. (plant), Edward W. Chester (leaf) and Dennis D. Horn (flower). Leaf and flower photo taken from TENN Vascular Plants – Database (<http://tenn.bio.utk.edu/>).

Page 8 taken from vPlants (<http://www.vplants.org/>).

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APPENDIX 1 - Insect visitors of *Silphium* spp. in Illinois

(From Insect Visitors of Prairie Wildflowers in Illinois: <http://www.shout.net/~jhilty/>)

***Silphium integrifolium* (Rosinweed)**

Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus impatiens*, *Bombus vagans*; Anthophoridae (Ceratinini): *Ceratina dupla dupla*; Anthophoridae (Epeolini): *Triepeolus concavus*, *Triepeolus remigatus*, *Triepeolus simplex*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes coloradensis*, *Melissodes trinodis*, *Svastra obliqua obliqua*; Anthophoridae (Xylocopini): *Xylocopa virginica*; Megachilidae (Megachilini): *Megachile brevis brevis*, *Megachile inimica sayi*, *Megachile mendica*, *Megachile montivaga*, *Megachile petulans*, *Megachile polycaris*, *Megachile pugnatus*

Bees (short-tongued): Halictidae (Halictinae): *Agapostemon sericea*, *Halictus ligatus*; Andrenidae (Andreninae): *Andrena accepta*

Flies: Bombyliidae: *Systoechus vulgaris*; Conopidae: *Physocephala tibialis*; Tachinidae: *Gymnoclytia occidua*

Butterflies: Nymphalidae: *Danaus plexippes*, *Vanessa cardui*; Pieridae: *Colias eurytheme*, *Pieris rapae*

Moths: Ctenuchidae: *Cisseps fulvicollis*

Beetles: Cantharidae: *Chauliognathus pennsylvanicus*

***Silphium laciniatum* (Compass Plant)**

Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus bimaculatus*, *Bombus fervidus*, *Bombus griseocallis*, *Bombus pennsylvanicus*, *Bombus vagans*; Anthophoridae (Ceratinini): *Ceratina dupla dupla*; Anthophoridae (Epeolini): *Triepeolus concavus*, *Triepeolus lunatus concolor*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes bimaculata bimaculata*, *Melissodes coloradensis*, *Svastra obliqua obliqua*; Megachilidae (Megachilini): *Megachile brevis brevis*, *Megachile parallela parallela*, *Megachile pugnata pugnata*

Bees (short-tongued): Halictidae (Halictinae): *Agapostemon texanus texanus*, *Agapostemon virescens*, *Halictus ligatus*, *Lasioglossum imitatus*, *Lasioglossum pilosus pilosus*

Flies: Syrphidae: *Allograpta obliqua*, *Eristalis stipator*, *Eristalis transversus*, *Tropidia mamillata*; Bombyliidae: *Systoechus vulgaris*, *Villa alternata*; Conopidae: *Zodion fulvifrons*, *Zodion obliquefasciatum*

Butterflies: Nymphalidae: *Danaus plexippes*; Pieridae: *Colias philodice*

***Silphium perfoliatum* (Cup Plant)**

Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus fraternus*, *Bombus griseocallis*, *Bombus impatiens*, *Bombus pensylvanica*, *Bombus vagans*; Anthophoridae (Ceratinini): *Ceratina dupla dupla*; Anthophoridae (Epeolini): *Triepeolus concavus*, *Triepeolus lunatus concolor*, *Triepeolus lunatus lunatus*, *Triepeolus remigata*, *Triepeolus simplex*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes bimaculata bimaculata*, *Melissodes coloradensis*, *Melissodes denticulata*, *Melissodes rustica*, *Melissodes trinodis*, *Melissodes vernoniae*, *Svastra obliqua obliqua*; Megachilidae (Coelioxini): *Coelioxys germana*; Megachilidae (Megachilini): *Megachile brevis brevis*, *Megachile inimica sayi*, *Megachile mendica*, *Megachile petulans*, *Megachile pugnatus*

Bees (short-tongued): Halictidae (Halictinae): *Agapostemon sericea*, *Agapostemon splendens*, *Agapostemon virescens*, *Augochlorella striata*, *Halictus ligatus*, *Halictus rubicunda*, *Lasioglossum imitatus*, *Lasioglossum pectoralis*, *Lasioglossum pilosus pilosus*, *Lasioglossum versatus*; Halictidae (Nomiinae): *Nomia triangulifera*; Andrenidae (Andreninae): *Andrena accepta*, *Andrena aliciae*; Andrenidae (Panurginae): *Heterosarus labrosiformis labrosiformis*, *Pseudopanurgus rugosus*

Wasps: Sphecidae (Sphecinae): *Ammophila procera*; Vespidae: *Polistes dorsalis*; Scoliidae: *Scolia bicincta*

Flies: Syrphidae: *Allograpta obliqua*, *Eristalis tenax*, *Milesia virginensis*; Bombyliidae: *Exoprosopa fasciata*, *Poecilanthrax alcyon*, *Sparnopolius confusus*, *Systoechus vulgaris*, *Villa alternata*; Conopidae: *Zodion obliquefasciatum*; Tachinidae: *Archytas aterrima*

Butterflies: Nymphalidae: *Chlosyne nycteis*, *Danaus plexippes*, *Limenitis archippus*, *Limenitis arthemis astyanax*, *Polygonia interrogationis*, *Vanessa atalanta*, *Vanessa cardui*, *Vanessa virginensis*; Lycaenidae: *Lycaena hyllus*; Pieridae: *Colias philodice*, *Pieris rapae*, *Pontia protodice*; Papilionidae: *Battus philenor*, *Papilio cresphontes*, *Papilio glaucus*, *Papilio troilus*

Skippers: Hesperidae: *Anatrytone logan*, *Epargyreus clarus*, *Pholisora catyllus*, *Poanes zabulon*, *Polites themistocles*

***Silphium terebinthinaceum* (Prairie Dock)**

Birds: Trochilidae: *Trochilus colubris*

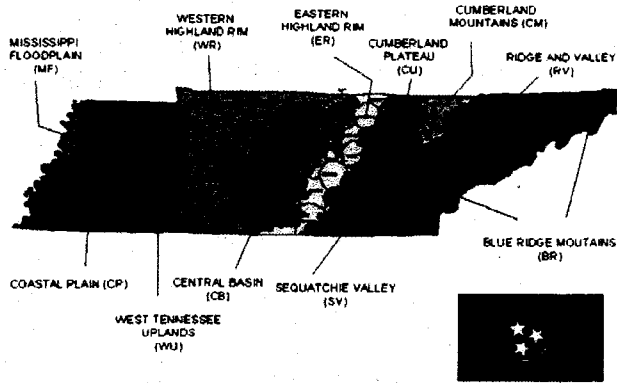
Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus bimaculatus*, *Bombus impatiens*, *Bombus pensylvanica*; Anthophoridae (Ceratinini): *Ceratina dupla dupla*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes coloradensis*, *Svastra obliqua obliqua*; Megachilidae (Megachilini): *Megachile brevis brevis*

Bees (short-tongued): Halictidae (Halictinae): *Agapostemon sericea*, *Halictus ligatus*, *Halictus rubicunda*

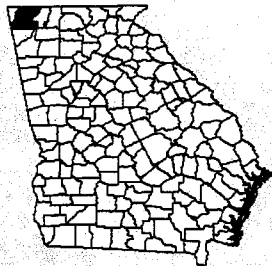
Wasps: Sphecidae (Sphecinae): *Ammophila procera*

Flies: Bombyliidae: *Sparnopolius confusus*, *Systoechus vulgaris*

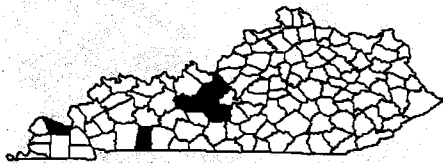
APPENDIX 2 – Physiographic Provinces of Tennessee. This map was taken from Tennessee Division of Natural Heritage (<http://www.state.tn.us/environment/nh/>) and <http://www.state.tn.us/environment/nh/physprov.php>.



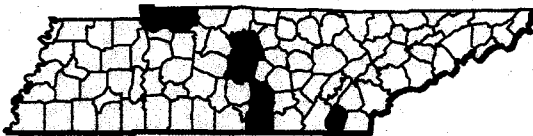
APPENDIX 3 - State county distribution maps. These maps may not show all the possible county records within a state. Maps were taken from the following online resources: the PLANTS Database (<http://plants.usda.gov/>), the University of Tennessee Herbarium (<http://tenn.bio.utk.edu/>), and Wisconsin State Herbarium database (<http://www.botany.wisc.edu/herbarium/>).



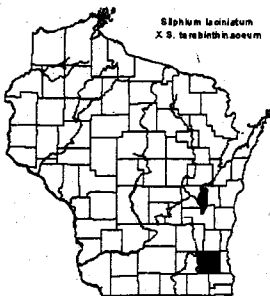
Georgia



Kentucky



Tennessee



Wisconsin