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Conservation Assessment
for
Silphium Sunflower (*Helianthus silphioides* Nutt.)

USDA Forest Service, Eastern Region

October 1, 2004

Shawnee National Forest
Hoosier National Forest

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Technical Report 2005(1)

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation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.

Helianthus silphioides Nutt. (Silphium sunflower), 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 *Helianthus silphioides*. 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 *Helianthus silphioides*.

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 Clark Danderson 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: *Helianthus silphioides* Nutt.

Common Names: Silphium sunflower, Rosinweed sunflower, Ozark sunflower

Synonomy: *Helianthus atrorubens* L. var. *pubescens* Kuntze, *Helianthus kentuckiensis* McFarland and Anderson[1]

USDA Plants Code: HESI

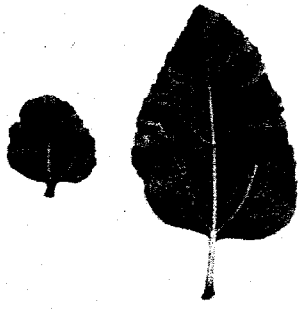
The species epithet, "*silphioides*" means "looks like *Silphium*" which is another genus in the family Asteraceae. The molecular phylogeny for the genus *Helianthus* based on nuclear restriction-fragment-length polymorphism (Gentzbittel et al. 1992) and random amplified polymorphism (Sossey-Alaoui et al. 1998) is very similar to many of the taxonomic classifications that have been developed based on morphological characters. *Helianthus silphioides* is under the Series *Atrorubentes* with *H. atrorubens*, *H occidentalis*, *H. rigidus*, and *H. porteri* (Sossey-Alaoui et al. 1998). However, the Section has been changed from *Divaricati* to *Atrorubentes* (Gentzbittel et al. 1992, Sossey-Alaoui et al. 1998).

[1] The original type of *Helianthus kentuckiensis* McFarland and Anderson (McFarland and Anderson 1924) was at the McFarland Herbarium, but no longer extant due to a fire that destroyed the collection. The isotype at the Missouri Botanical Garden has been designated as the lectotype (Heiser et al. 1969).

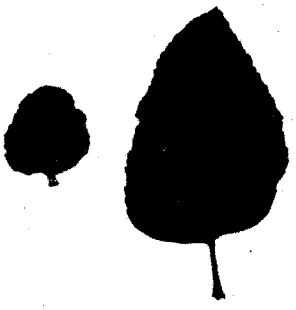
DESCRIPTION OF SPECIES

Helianthus silphioides is a showy perennial with several stems up to 3m tall rising from a short rhizome or crown (Carman 2001, Gleason and Cronquist 1991, Steyermark 1963). One key character that aids in the recognition of this species is the rounded-ovate, to nearly orbicular, blunt-tipped or rounded leaves, which are mostly in the basal half of the plant (Smith 1994). These lower leaves are opposite and are less

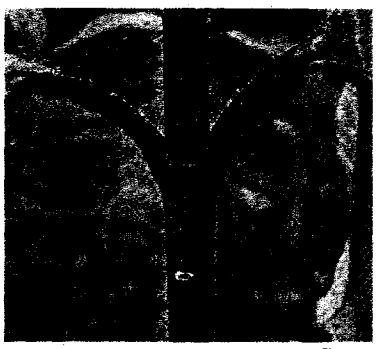
than 1.7 times as long as wide (Carman 2001, Heiser et al. 1969). In addition, the leaves tend to fold longitudinally. Stem leaves abruptly contract to a slender petiole (mostly 1/3 or less the length of the blade) and upper leaves are always alternate and reduced in size toward the top of the stem (these are abruptly contracted in *H. atrorubens*, another very similar species). Leaf margin is entire and undulate. Leaf venation may be pinnate or other. Leaves and stems are hairy (see below photos).



Lower surface of leaves



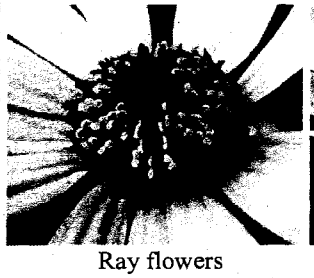
Upper surface of leaves



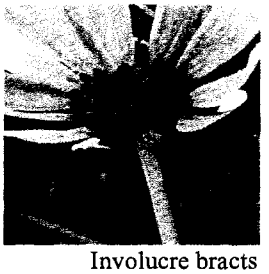
Stem

Several large (up to 7.6 cm wide), showy inflorescences can be found on the long naked stems. Each inflorescence has perfect and fertile disk florets with sterile ray florets (see below photos). The corolla lobes of the disk florets are dark red to red. Styles are yellow or red. Ten to 15 yellow ray florets (about 2 cm long) can be found in an inflorescence. Involucre bracts are rounded at the tip. Achenes are 3-4 mm long with pubescence only at the summit. This species blooms from August to September across most of its range (Heiser et al. 1969). In Illinois, *Helianthus silphioides* blooms from July to October (Mohlenbrock 2002). This species has a chromosome number of 34 (2n) (Heiser et al. 1969).

Inflorescences



Ray flowers



Involucre bracts

Helianthus silphioides can be confused with other *Helianthus* spp., in particular *Helianthus atrorubens* (Appalachia sunflower), and can be easily confused where their ranges overlap in Alabama, Kentucky, Louisiana, Mississippi, and especially Tennessee (Carman 2001, Gleason and Cronquist 1991, USDA-NRCS 2004). *Helianthus atrorubens* usually has solitary stems and the leaves are more basally disposed with petioles longer than 1/3 the length of the blade and the wing-flared upward. Finally, it is

possible that *Helianthus silphioides* can be confused with *Heliopsis helianthoides* (false sunflower, oxeye sunflower). However, *Heliopsis helianthoides* has opposite toothed leaves, fertile ray florets, and yellow disk florets.

LIFE HISTORY

Research has been conducted on the reproductive biology, ecology, and dispersal of other *Helianthus* spp., mostly *Helianthus annuus.* Limited to no information is available regarding the reproduction biology, ecology, and dispersal of *Helianthus silphioides.* Most of the reproductive cycle of the species is within the months of early July to late October. *Helianthus silphioides* flowers, as with other *Helianthus* spp. are likely visited by a wide variety of pollinators (W1, see Appendix 1) that collect and feed on pollen or nectar. In addition, this species should be an out-crosser since no *Helianthus* spp. are known to be self-pollinated (Heiser et al. 1969, Gentzbittel et al. 1992).

In general, seed dispersal among *Helianthus* spp. is considered to be limited without a biotic factor (i.e., animal or human, Heiser et al. 1969). Because *Helianthus silphioides* produces achenes lacking a persistent pappus modified for animal or wind dispersal, they are more likely to fall and stay under the maternal plant. Although the lack of a persistent pappus is typical for most *Helianthus* spp., it is possible that birds or mammals can act as dispersal agents for this species as the result of trying to feed on the achenes (Heiser et al. 1969). In addition, because this species is found along roadsides it is possible that human activity (e.g., mowing) could contribute to seed dispersal.

Seed germination requirements are unknown, but some *Helianthus* spp. require no treatment (*H. occidentalis*; Shirley 1994) while others need at least cold stratification (*H. grosseserratus*, *H. mollis*, and *H. strumosus*; Rock 1977). Heiser et al. (1969) reported that in general most *Helianthus* spp. (not including cultivar forms) have very low rates of seed germination.

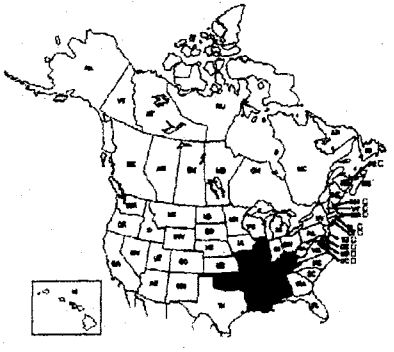
HABITAT

Helianthus silphioides can be found in a wide variety of habitats across its range. In the southeastern corner of Missouri *Helianthus silphioides* is found in low, sandy soil near streams, borders of woods, dry upland woods, thickets, or roadsides, and is typically on acid soils (W2). In Kentucky, it can also be found in low, sandy alluvial soils, fallow fields, woodland borders, open dry uplands, thickets and roadsides (W3). In Tennessee, *Helianthus silphioides* is found in dry open woods (Carman 2001). In Mississippi, this species has been found on ridgetops within secondary woods of oak, hickory, pine, and cedar (Mark Fishbein, Director, Mississippi State University Herbarium). In Louisiana, this species potentially grows in mixed pine-hardwoods, along edges of woods, pine woods, and along roadsides (W4; Louisiana State University Herbarium; Anne S. Bradburn, Curator, Tulane University Herbarium pers. comm.). In Alabama, this species has been collected from mixed forests and sandy soils (Steve Ginzbarg, Assistant Curator, University of Alabama Herbarium, pers. comm.).

Herbarium specimens of *Helianthus silphioides* have been collected along borders of woods, in upland, dry-open woods, and along roads in Illinois. In addition, the Illinois Plant Information Network (Iverson et al. 1999) listed this species to be found in the following Illinois natural communities: forest: upland forest (dry and dry-mesic), thickets; prairie: typical prairie (dry, dry-mesic, and mesic); savanna: typical savanna (dry-mesic and mesic); wetland: border of lake; and cultural: agricultural field, successional field, and developed land.

No information is available for the habitat of this species in the Shawnee National Forest. However, in the Mark Twain National Forest *Helianthus silphioides* is most commonly found in dry, rocky chert woodlands, sometimes in cherty dry to dry-mesic bottomland woodlands. It does well in prescribed burn sites. In the dry chert woodlands of Missouri this species can be found growing with canopy trees such as black hickory (*Carya texana*), scarlet oak (*Quercus coccinea*), and black jack oak (*Q. marilandica*); understory trees such as: farkleberry (*Vaccinium arboreum*), sassafras (*Sassafras albidum*), and southern black haw (*Viburnum rufidulum*); shrubs and vines such as: lead plant (*Amorpha canescens*), New Jersey tea (*Ceanothus americanus*), and summer grape (*Vitis aestivalis*); and herbaceous plants such as: little bluestem (*Schizachyrium scoparium*), poverty grass (*Danthonia spicata*), bristly sunflower (*Helianthus hirsutus*), dittany (*Cunila origanoides*), sedges (*Carex albicans*, *C. glaucodea*, *C. hirsutella*, *C. muehlenbergii*, *Carex nigromarginata* var. *nigromarginata*, and *C. retroflexa*), asters (*Aster anomalus*, *A. patens*, and *A. turbinellus*), bush clovers (*Lespedeza procumbens*, *L. repens*, and *L. virginica*), pussytoes (*Antennaria parlinii*), big bluestem (*Andropogon gerardii*), wild quinine (*Parthenium integrifolium*), purple and white prairie clovers (*Dalea purpurea*, *D. candida*), tick trefoils (*Desmodium marilandicum*, *D. obtusum*, and *D. rotundifolium*), bush clovers (*Lespedeza hirta*, *L. procumbens*, and *L. violacea*), goat's rue (*Tephrosia virginiana*), sensitive briar (*Schrankia nuttallii*), blazing stars (*Liatris aspera*, *L. squarrosa*), cream white indigo (*Baptisia bracteata*), panic grasses (*Panicum acuminatum*, *P. linearifolium*, and *P. sphaerocarpon*), goldenrods (*Solidago hispida*, *S. nemoralis*, *S. petiolaris*, and *S. ulmifolia*), asters (*Aster anomalus*, *A. linariifolius*, and *A. patens*), finger coreopsis (*Coreopsis palmata*), and bashful bulrush (*Trichophorum planifolium*) (Paul W. Nelson, Ecology and Land Management Planner; David Moore, Forest Botanist/Ecologist Mark Twain National Forest pers. comms.).

DISTRIBUTION AND ABUNDANCE



Helianthus silphioides has been reported in the following states: Alabama, Arkansas, Illinois, Kentucky, Louisiana, Missouri,

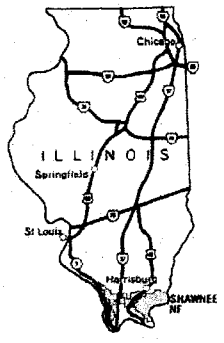
Mississippi, Oklahoma, and Tennessee (NatureServe Explorer 2004, USDA-NRCS 2004, see Appendix 2 for color codes). For most of these states limited information is available regarding the distribution and abundance of the species. Appendix 3 shows the county distributions for Arkansas, Kentucky, Missouri, and Tennessee. It should be noted that there are no specimens listed as *Helianthus silphioides* in the Oklahoma Vascular Plants Database (Wayne J. Elisens Curator of the Bebb Herbarium, University of Oklahoma, pers. comm.).

In Louisiana, this species has been collected in Morehouse County (1977) (one specimen; Anne S. Bradburn, Curator, Tulane University Herbarium pers. comm.). In Arkansas, *Helianthus silphioides* has been collected in Green County (one specimen [1981]; Freeman Herbarium Database at Auburn University; two specimens [1948 and 1949] Rebecca Dolan Director Friesner Herbarium, pers. comm.); and in Craighead (1948) and Oktibbeha (2004) counties (Mark Fishbein, Director, Mississippi State University Herbarium). Also, from the United States National Herbarium in Washington DC *Helianthus silphioides* has been collected in Carroll (1933) and Pulaski (1931) counties in Arkansas.

In Kentucky, *Helianthus silphioides* has been collected in Hickman (two specimens [1942 and 1944], Rebecca Dolan Director Friesner Herbarium, pers. comm.) and Bell (1937) counties (United States National Herbarium in Washington DC). In Alabama, *Helianthus silphioides* has been collected in Fayette (1999), Cleburne (1985), and Lee (1896) counties (Steve Ginzbarg, Assistant Curator, University of Alabama Herbarium, pers. comm.).

In Illinois this species has been documented in two counties, Alexander and St. Clair (Mohlenbrock 2002). However, documents from the Shawnee National Forest (Shimp 2001, Anonymous 2003) and the USDA PLANTS Database (USDA-NRCS 2004) have reported this species as extirpated or as thought to be extirpated from Alexander County. In Alexander County a specimen was collected by Otto Kuntze in Cairo, IL 1874 and it was identified as *Helianthus atrorubens* var. *pubescens* (Mohlenbrock and Voight 1959). At the Illinois Natural History Survey Herbarium (as of December 2003) a total of seven specimens are available, six from St. Clair County and one from Bollinger County Missouri (2003). St. Clair County's specimens were collected during the period of 1949 to 1961 along road banks. The Southern Illinois University Herbarium has two records for *Helianthus silphioides* from St. Clair County, one collected in 1960 and the other in 1961 (Michael Mibb, Assistant Curator, pers.

comm.). Steyermark (1963) mentioned that he grew the species in his preserve in northern Illinois and that for many years the plants did well in open sunny places.



Finally, the Shawnee National Forest herbarium does not have specimens of *Helianthus silphioides* and no populations of this species are known from the Shawnee National Forest.

The Indiana Natural Heritage Data Center has no records or elements of occurrence for *Helianthus silphioides* in Indiana (Ronald P. Hellmich pers. comm., Indiana Natural Heritage Data Center; Michael Homoya INDNR-Division of Nature Preserves, pers. comm). Also, the Indiana University Herbarium has no records for this species (Eric Knox Curator, pers. comm.). Yatskievych (2000) did not list this species as being found in Indiana. However, it should be noted that Deam recorded the species in 1946 in the Proceedings of the Indiana Academy of Science (Deam et al. 1946), but the record was changed to *Helianthus laetiflorus* var. *subrhomboideus* in 1950 (Deam et al. 1950) (Kay Yatskievych, pers. comm.). At the Friesner Herbarium (Butler University, Indiana, Rebecca Dolan Director pers. comm.), four specimens collected in Wells County by C.C. Deam in 1943 can be found. However, based on the herbarium labels the specimens came originally from a plant that was dug from Road 58 in Hickman County, Kentucky by Frank T McFarland. This plant was planted in a garden at Bluffton Indiana.

Helianthus silphioides is found in the southeastern portion of Missouri (i.e., southern Ozark counties; Appendix 3). The Ozarks Regional Herbarium in Missouri has no specimens for *Helianthus silphioides* (Laura Michelle Bowe, pers. comm., Curator Ozarks Regional Herbarium; Southwest Missouri State University). However, based on the Missouri Botanical Garden Flora of Missouri project (W5) *Helianthus silphioides* has been collected in Carter County (1989) and Bollinger County (1999). Also one specimen found at the United States National Herbarium was collected in Cooper County (Pleasant Grove, 1899). At the Mark Twain National Forest, it grows

on the Doniphan/Eleven Point Ranger District (Paul W. Nelson, Ecology and Land Management Planner Mark Twain National Forest pers. comm.).

RANGE WIDE STATUS

Global Heritage Status: The Nature Conservancy (TNC) and Association for Biodiversity Information (ABI) have ranked this species as G3G4 (April 20, 1994). The species received a G ranking from botanists that gathered at the 1992 Nature Conservancy southeastern conference (NatureServe Explorer 2004). They pointed out that *Helianthus silphioides* is fairly abundant in a somewhat limited range (NatureServe Explorer 2004; G3 - *Vulnerable:* At moderate risk of extinction due to a restricted range, relatively few populations [often 80 or fewer], recent and widespread declines, or other factors. G4 - *Apparently Secure:* Uncommon but not rare; some cause for long-term concern due to declines or other factors; G#G# - *Range Rank*: A numeric range rank [e.g., G3G4] is used to indicate any range of uncertainty about the status of the species. Ranges cannot skip more than one rank [i.e., G3G4]).

National Heritage Status: The Nature Conservancy (TNC) and Association for Biodiversity Information (ABI) have ranked this species as N3N4 (March 9, 1995) (NatureServe Explorer 2004; N3- *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. N4 - *Apparently Secure:* Uncommon but not rare; some cause for long-term concern due to declines or other factors; N#N# - *Range Rank*: A numeric range rank [e.g., N3N4] is used to indicate any range of uncertainty about the status of the species. Ranges cannot skip more than one rank [i.e., N3N4]).

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 *Helianthus silphioides* has been reported within the boundaries of the Mark Twain National Forest, but is not designated as a Regional Forester's Sensitive species because it is believe to be not at risk. At the Shawnee National Forest the species has been designated as a Regional Forester's Sensitive species. *Helianthus silphioides* is not considered a Regional Forester's Sensitive species at Hoosier National Forest and is not known to occur there.

State Status: Alabama (SNR), Arkansas (SNR), Illinois (S1?), Kentucky (S1), Louisiana (S2S3), Mississippi (S4?), Missouri (SNR), Oklahoma (S1), Tennessee (S2S3) (see Appendix 2 for distribution map color codes; NatureServe Explorer 2004). Definitions for rankings are: S1 - *Critically Imperiled*: Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state; 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 nation or 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; S4 - *Apparently Secure*:

Uncommon but not rare; some cause for long-term concern due to declines or other factors; S? - *Inexact or Uncertain*: Denotes inexact or uncertain numeric rank; S#S# - *Range Rank*: A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (i.e., S2S3); SNR - *Unranked*: State conservation status not yet assessed.

POPULATION BIOLOGY AND VIABILITY

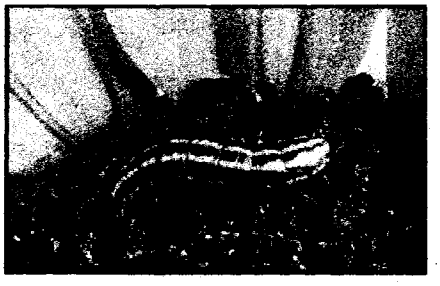
Currently, no information is available on population and viability estimates for *Helianthus silphioides*. Based on the global and state status (see above), in most cases few populations have been reported. Label information from a specimen at the United States National Herbarium in Washington DC, collected October 1947 in Kentucky, stated that the specimen came from a population consisting of more than 100 flower stems. However, the potential threats listed below can have a negative impact on the structure and viability of *Helianthus silphioides* populations, since most of them can lead to reduction in population size or plant recruitment.

POTENTIAL THREATS

The principal threats to *Helianthus silphioides* are conversion of habitat to closed-canopy pine plantations, agriculture, or pastureland, invasion of habitat by exotic plant species such as kudzu or Japanese honeysuckle, and development (NatureServe Explorer 2004).

In addition to the above threats, the commercial use of this species can become a problem. *Helianthus silphioides* is being collected and sold in seed catalogs such as the Pine Ridge Gardens in Arkansas (W6). It should be noted that the web site gives a general description of the species and even mentions that *H. silphioides* is native to Arkansas and considered endangered in Kentucky due to habitat loss.

As with other members of the genus *Helianthus*, insect (i.e., herbivory by moths, weevils, maggots; W7) and disease (i.e., fungal, bacterial, and viral; W8 and W9) damage to inflorescence, leaves, and stems can happen. For example, in the case of insect damage the Sunflower Moth (*Homoeosoma electellum* [Lepidoptera: Pyralidae]) can potentially damage the flowers and achenes of *H. silphioides* since this moth species is a well known pest of wild or domesticated *Helianthus* spp. (W7). In general, a moth can lay an average of about 104 eggs within or among corolla tubes of individual florets. Eggs will hatch in 3-5 days, the larva will go through 4 - 5 instars, the pupa will pupate in the soil, and the adult will live a couple of weeks. The larvae will lay a delicate silk over the inflorescence surface and the early instars will feed on the florets rather than the achenes. Severe infestations can cause 30 - 60% florets to be lost. Seiler et al. (1984) found a resistance factor, phytomelanin, in the pericarp of 50 species of wild sunflower (including *H. silphioides*) that can decrease damage.



The Sunflower Moth (*Homoeosoma electellum* [Lepidoptera: Pyralidae]; W7)

In the case of diseases downy mildew, alternaria, powdery mildew, verticillium wilt, leaf spot, rust, Sunflower mosaic, and Aster yellows among others, have the potential of infecting *H. silphioides* (W8 and W9).

Figure 59. Stem lesions caused by *Alternaria helianthi*.

Figure 72. Plants infected with Verticillium wilt show interveinal necrosis with yellow margins.

Photos taken from http://www.helianthus.com/english/pics.htm (W8).

Finally, another concern associated with this species is the potential of hybridization with other *Helianthus* spp. Hybridization among *Helianthus* spp. is well documented (Heiser and Smith 1964; Heiser et al. 1969, Long 1955, Rogers et al. 1982). In the case of *Helianthus silphioides*, this species does not seem to hybridize with other *Helianthus* spp. with the exception of *Helianthus atrorubens* under artificial conditions (i.e., greenhouse) and where their ranges overlap (Heiser et al. 1969). However if hybridization occurs it 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 *Helianthus silphioides* populations.

RESEARCH AND MONITORING

Botanists from the Shawnee National Forest and Mark Twain National Forest are actively looking for new populations since it is Forest Service policy that areas of the Forest 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 can be

affected (Shimp 2001). However, systematic inventories are needed to determine new locations for this species in Illinois and the rest of its range.

As with many threatened, endangered, and sensitive species, no known monitoring programs are currently taking place for *Helianthus silphioides*. A long-term monitoring program must be developed to be able to determine demographic trends. Gathering information on the natural history, reproductive biology, and genetic diversity, as well as the impact of management techniques on this species, are needed. All this information is necessary to develop the best conservation and management strategies.

CONSERVATION AND RESTORATION EFFORTS

Although no official conservation program has been developed for *Helianthus silphioides*, germplasm has been collected as part of the "World Information and Early Warning System (WIEWS) on Plant Genetic Resources for Food and Agriculture (PGRFA), Germplasm Species in Ex-situ Collections" (W10). Five accessions collected in Arkansas can be found at North Central Regional Plant Introduction Station, USDA-ARC, NCRPIS, Iowa State University (W11). Also, the European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR) has germplasm specimens that can be found in Braunshweig, Germany (Frison and Serwinski 1995). Finally, there are no known restoration activities focusing specifically on the habitats for *Helianthus silphioides*.

SUMMARY

Helianthus silphioides Nutt. (Silphium sunflower) is a perennial plant found in nine states: Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma, and Tennessee. This species is found mostly in woodlands. Globally, it has a ranking of G3G4 (fairly abundant in a somewhat limited range). Across its range it is critically imperiled to apparently secure where information is available. In Illinois, it is thought to be critically imperiled (S1?) and has been documented in two southern counties (Alexander and St. Clair), however it has since been declared extirpated from Alexander County. The species has been included on the Regional Forester's Sensitive Species list (RFSS) for the Shawnee National Forest. At the Mark Twain National Forest *Helianthus silphioides* is present but is not designated as RFSS because it is not believed to be at risk. Several threats such as habitat changes, collection for commercial uses and insect/disease damage could have a negative impact on the species.

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 *Helianthus silphioides*. Searches for new populations and research on life history, hybridization (e.g., hybrid zone, swarm, taxon), habitat requirements, and possible 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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W2- Missouriplants.com: http://www.missouriplants.com/.

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W6- Pine Ridge Gardens: http://www.pineridgegardens.com/2003_Per3.htm).

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http://www.ars-grin.gov/ars/MidWest/Ames/Entomology/Sunflower%20Moth.html

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W9- Common Names of Plant Diseases:
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Freeman Herbarium Database at Auburn University. Currently this online database is unavailable, for information contact:
Curtis J. Hansen, Curator
The John D. Freeman Herbarium (AUA)
Auburn University
Biological Sciences Department
101 Life Sciences Bldg
Auburn, AL 36801
Tel: 334-844-1630
Fax: 334-844-1645
Email: hansecj@auburn.edu
Url: www.auburn.edu/herbarium

Missouri Botanical Garden Flora of Missouri project (see W5)

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 taken from TENN Vascular Plants – Database. Dr. B. Eugene Wofford, herbarium director (Email - bewofford@utk.edu) granted permission to use the image. Photo taken by Dennis D. Horn.

Pages 6 and 7 taken from The Missouri Flora Website (http://www.missouriplants.com/) created by Dan Tenaglia (Email - moflora@hotmail.com).

Page 14 (Sunflower moth), taken from http://www.ars-grin.gov/ars/MidWest/Ames/Entomology/Sunflower%20Moth.html.

Page 14 *Alternaria helianthi* and verticillium wilt taken from http://www.helianthus.com/english/pics.htm

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APPENDIX 1- Insect visitors of *Helianthus* spp. in Illinois
(From Insect Visitors of Prairie Wildflowers in Illinois: http://www.shout.net/~jhilty/)

***Helianthus giganteus* (Giant Sunflower)**

Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus affinis*, *Bombus griseocallis*, *Bombus pensylvanica*, *Bombus vagans*; Anthophoridae (Eucerini): *Melissodes trinodis*; Anthophoridae (Nomadini): *Nomada graenicheri*; Anthophoridae (Xylocopini): *Xylocopa virginica*; Megachilidae (Megachilini): *Megachile latimanus*

Bees (short-tongued): Halictidae (Halictinae): *Augochlorella striata*; Andrenidae (Andreninae): *Andrena aliciae*, *Andrena chromotricha*, *Andrena helianthi*

Wasps: Vespidae (Eumeninae): *Euodynerus foraminatus*

Flies: Bombyliidae: *Sparnopolius confusus*; Syrphidae: *Eristalis tenax*, *Eristalis transversus*; Calliphoridae: *Lucilia caesar*; Muscidae: *Musca domestica*

Butterflies: Pieridae: *Colias philodice*, *Pieris rapae*; Papilionidae: *Papilio polyxenes asterias*

Beetles: Chrysomelidae: *Diabrotica undecimpunctata*

***Helianthus mollis* (Downy Sunflower)**

Bees (long-tongued): Apidae (Bombini): *Bombus pensylvanica*; Anthophoridae (Epeolini): *Triepeolus concavus*, *Triepeolus cressonii cressonii*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes coloradensis*, *Melissodes trinodis*, *Svastra obliqua obliqua*; Megachilidae (Coelioxini): *Coelioxys octodentata*; Megachilidae (Megachilini): *Megachile brevis brevis*, *Megachile latimanus*, *Megachile parallela parallela*, *Megachile petulans*

Bees (short-tongued): Halictidae (Halictinae): *Agapostemon virescens*, *Augochlorella aurata*, *Augochloropsis metallica metallica*, *Halictus ligatus*, *Lasioglossum pilosus pilosus*, *Lasioglossum versatus*; Andrenidae (Panurginae): *Heterosarus albitarsis*, *Pseudopanurgus rugosus*

Flies: Syrphidae: *Eristalis stipator*, *Tropidia mamillata*; Bombyliidae: *Exoprosopa decora*, *Poeciloanthrax alcyon*, *Systoechus vulgaris*

Butterflies: Nymphalidae: *Danaus plexippes*, *Phyciodes tharos*; Pieridae: *Colias philodice*

***Helianthus rigidus* (Prairie Sunflower)**

Bees (long-tongued): Apidae (Bombini): *Bombus fraternus*, *Bombus griseocallis*, *Bombus pensylvanica*; Anthophoridae (Epeolini): *Triepeolus concavus*; Anthophoridae (Eucerini): *Melissodes agilis*, *Svastra obliqua obliqua*; Megachilidiae (Megachilini): *Megachile brevis brevis*, *Megachile inimica sayi*, *Megachile latimanus*

Bees (short-tongued): Halictidae (Halictinae): *Halictus ligatus*, *Lasioglossum pectoralis*, *Lasioglossum pilosus pilosus*, *Lasioglossum versatus*

Wasps: Sphecidae (Sphecinae): *Ammophila nigricans*; Ichneumonidae: *Ceratogastra ornata*

Flies: Syrphidae: *Eristalis stipator*, *Eristalis transversus*; Bombyliidae: *Exoprosopa fasciata*, *Sparnopolius confusus*, *Systoechus vulgaris*; Tachinidae: *Plagiomima spinosula*

Butterflies: Nymphalidae: *Phyciodes tharos*

Skippers: Hesperiidae: *Pholisora catyllus*

Moths: Ctenuchidae: *Cisseps fulvicollis*

Plant Bugs: Miridae: *Lygus lineolaris*

***Helianthus strumosus* (Pale-Leaved Sunflower)**

Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus centralis*, *Bombus griseocallis*, *Bombus pensylvanica*, *Bombus ternarius*, *Bombus vagans*, *Psithyrus citrinus*; Anthophoridae (Ceratinini): *Ceratina dupla dupla*; Anthophoridae (Epeolini): *Triepeolus concavus*, *Triepeolus cressonii cressonii*, *Triepeolus donatus*, *Triepeolus pectoralis*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes desponsa*, *Melissodes rustica*, *Melissodes trinodis*, *Svastra obliqua obliqua*; Anthophoridae (Nomadini): *Nomada graenicheri*, *Nomada vincta*; Anthophoridae (Xylocopini): *Xylocopa virginica*; Megachilidae (Anthidinini): *Paranthidium jugatoria*; Megachilidae (Coelioxini): *Coelioxys funeraria*, *Coelioxys modesta*, *Coelioxys octodentata*, *Coelioxys rufitarsis rufitarsis*, *Coelioxys sayi*, *Coelioxys texana*; Megachilidae (Megachilini): *Megachile brevis brevis*, *Megachile cetuncularis*, *Megachilie latimanus*, *Megachile mendica*, *Megachile petulans*, *Megachile pugnatus*; Megachilidae (Osmiini): *Hoplitis cylindricus*, *Hoplitis pilosifrons*; Megachilidae (Trypetini): *Heriades carinatum*

Bees (short-tongued): Halictidae (Halictinae): *Agapostemon sericea*, *Agapostemon virescens*, *Augochlorella striata*, *Halictius confusus*, *Halictus*

rubicunda, *Lasioglossum albipennis*, *Lasioglossum coriaceus*, *Lasioglossum pectoralis*; Andrenidae (Andreninae): *Andrena accepta*, *Andrena aliciae*, *Andrena chromotricha*, *Andrena helianthi*, *Andrena peckhami*; Andrenidae (Panurginae): *Heterosarus labrosiformis labrosiformis*, *Heterosarus rudbeckiae*

Wasps: Sphecidae (Bembicinae): *Bembix americana*; Sphecidae (Crabroninae): *Ectemnius maculosus*; Sphecidae (Philanthinae): *Philanthus bilunatus*; Sphecidae (Sphecinae): *Ammophila kennedyi*, *Ammophila nigricans*; Vespidae: *Dolichovespula arenaria*; Vespidae (Eumeninae): *Ancistrocerus antilope*

Flies: Bombyliidae: *Exoprosopa decora*, *Exoprosopa fascipennis*, *Poecilanthrax halcyon*, *Poecilognathus punctipennis*, *Sparnopolius confusus*, *Systoechus vulgaris*; Stratiomyidae: *Stratiomys normula*; Conopidae: *Zodion fulvifrons*; Syrphidae: *Allograpta obliqua*, *Eristalis anthophorina*, *Eristalis dimidiatus*, *Eristalis flavipes*, *Eristalis tenax*, *Eristalis transversus*, *Sericomyia militaris*, *Syritta pipiens*, *Syrphus ribesii*, *Toxomerus geminatus*, *Toxomerus marginatus*, *Tropidia quadrata*; Milichiidae: *Eusiphona mira*; Anthomyiidae: *Anthomyia leucostoma*; Calliphoridae: *Lucilia caesar*, *Phormia regina*; Tachinidae: *Mochlosoma* sp., *Tachinomyia panaetius*

Butterflies: Nymphalidae: *Chlosyne nycteis*, *Danaus plexippes*, *Limenitis arthemis astyanax*, *Phyciodes tharos*, *Speyeria cybele*, *Vanessa atalanta*, *Vanessa virginiensis*; Pieridae: *Colias philodice*, *Pieris rapae*; Lycaenidae: *Celastrina argiolus*

Moths: Noctuidae: *Anagrapha falcifera*, *Feltia jaculifera*, *Pseudaletia unipuncta*

Beetles: Buprestidae: *Acmaeodera pulchella*; Meloidae: *Epicauta pensylvanica*; Mordellidae: *Mordellistena comata*

Plant Bugs: Miridae: *Adelphocoris rapidus*, *Lygus pratensis*

***Helianthus annus* (Annual Sunflower)**

Bees (long-tongued): Apidae (Apinae): *Apis mellifera*; Apidae (Bombini): *Bombus bimaculatus*, *Bombus griseocallis*, *Bombus impatiens*, *Bombus pensylvanica*, *Bombus vagans*, *Psithyrus variabilis*; Anthophoridae (Ceratini): *Ceratina dupla dupla*; Anthophoridae (Epeolini): *Triepeolus concavus*; Anthophoridae (Eucerini): *Melissodes agilis*, *Melissodes bimaculata bimaculata*, *Melissodes boltoniae*, *Melissodes coloradensis*, *Melissodes comptoides*, *Melissodes dentiventris*, *Melissodes trinodis*, *Svastra atripes atripes*, *Svastra obliqua obliqua*; Megachilidae (Megachilini): *Megachile inimica sayi*, *Megachile latimanus*, *Megachile mendica*

Bees (short-tongued): Halictidae (Doufoureinae): *Doufourea marginatus marginatus*; Halictidae (Halictinae): *Agapostemon texanus texanus*, *Agapostemon*

virescens, *Augochlorella striata*, *Augochlorosis metallica metallica*, *Halictus confusus*, *Halictus ligatus*, *Halictus rubicunda*, *Lasioglossum imitatus*, *Lasioglossum pilosus pilosus*, *Lasioglossum versatus*; Halictidae (Nomiinae): *Nomia heteropoda*, *Nomia triangulifera*, *Nomia heteropoda kirbii*; Andrenidae (Andreninae): *Andrena accepta*, *Andrena helianthi*

Flies: Syrphidae: *Eristalis brousii*, *Eristalis transversus*, *Syritta pipiens*; Bombyliidae: *Sparnopolius confusus*, *Villa alternata*

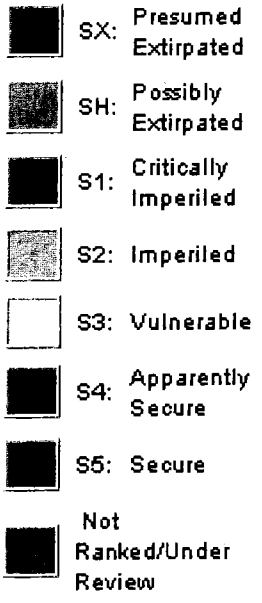
Butterflies: Nymphalidae: *Danaus plexippes*, *Speyeria cybele*; Pieridae: *Pieris rapae*

Skippers: Hesperiidae: *Polites themistocles*

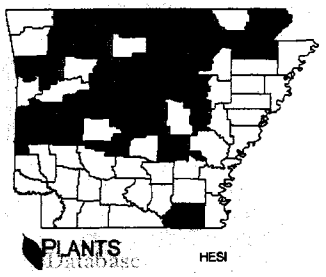
Beetles: Cantharidae: *Chauliognathus pennsylvanicus*; Chrysomelidae: *Diabrotica vittata*, *Diabrotica undecimpunctata*

Plant Bugs: Miridae: *Lygus lineolaris*

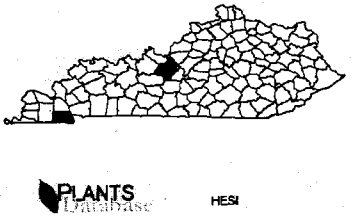
APPENDIX 2 - Distribution map color codes for state conservation status (NatureServe Explorer 2004).



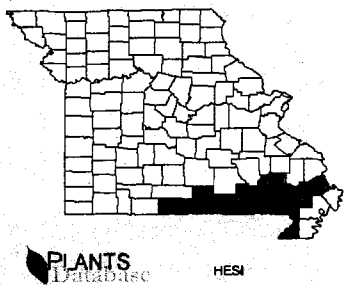
APPENDIX 3 - State county distribution maps. These maps may not show all the possible county records within a state. Maps were taken from the following online resources: the PLANTS Database (http://plants.usda.gov/) and the University of Tennessee Herbarium (http://tenn.bio.utk.edu/).



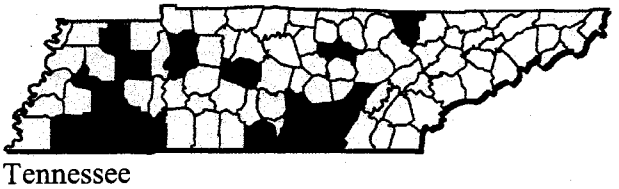
Alabama



Kentucky



Missouri


Tennessee