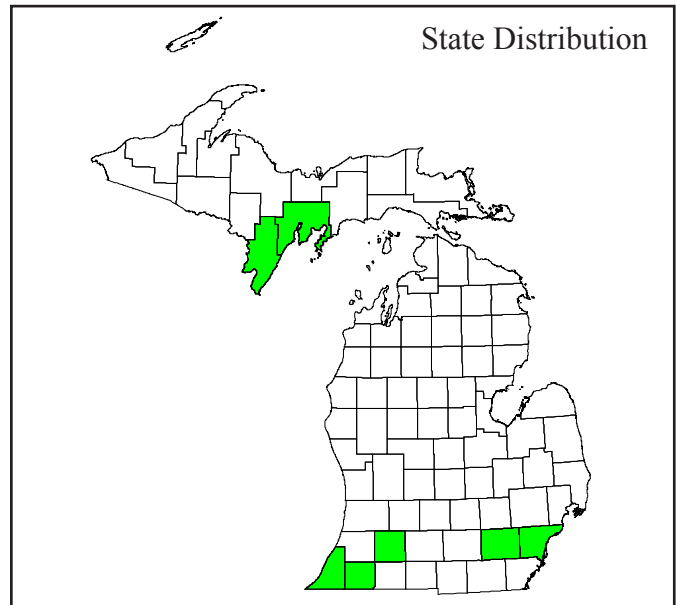
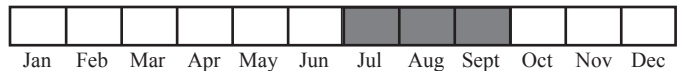




Photo by Bradford S. Slaughter



Best Survey Period



**Status:** State threatened

**Global and state rank:** G5/S1S2

**Family:** Asteraceae (aster family); also known as the Compositae

**Synonym:** *Silphium laciniatum* var. *robinsonii* L.M. Perry

**Taxonomy:** The Asteraceae or Compositae is a very large family of flowering plants, with perhaps greater than 20,000 species (Voss 1996). The North American genus *Silphium* contains several species of large, perennial herbs characterized by showy heads with sterile disk flowers and conspicuous yellow or white fertile, pistillate rays, undivided styles, imbricate ovaries in 2-3 series, and wing-margined, strongly flattened achenes or cypsela. Many species in the genus bear large, coarse leaves.

**Range:** Compass plant is widespread in the central United States and Canada, where the species occurs from Colorado and New Mexico east and north to Ontario, Pennsylvania, and Ohio, and south to Alabama (NatureServe 2009). The species is considered vulnerable in South Dakota, imperiled in Kentucky and Tennessee, and critically imperiled in Ontario,

Michigan, and Ohio. Compass plant is considered introduced in New York and Washington, D.C.

**State distribution:** Compass plant is known from 13 occurrences in Michigan. Eleven of these occurrences are from southern Lower Michigan, where the species has been documented from Berrien, Cass, Kalamazoo, Jackson, Washtenaw, Wayne, and St. Clair counties. Some of these populations (e.g., Jackson, Washtenaw, Wayne, and St. Clair counties) are likely adventive along railroads (Voss 1996). Compass plant has also been documented from two occurrences in the Upper Peninsula, one site each in Menominee and Delta counties.

**Recognition:** Compass plant is a large, **erect, taprooted perennial forb** ranging to 3 m in height, characterized by a **hirsute, hispid, or scabrous stem, large, coarse, deeply lobed basal leaves, alternate, petiolate or sessile pinnatifid or bipinnatifid cauline leaves** (reduced to small, entire leaves on the upper portion of the stem), and **numerous large heads in a narrow, sometimes racemiform inflorescence**. The 2-3 cm wide disk is exceeded by the involucre, which contains **ovate, acuminate, squarrose phyllaries** with hispid to scabrous, more-or-less stipitate-glandular abaxial faces. **Ray corollas are large (2-5 cm), conspicuous, and yellow**. The fruit is a large (to 1.8 cm long and 1.2



cm wide), flattened achene or cypsela containing small obovate seeds. Three other *Silphium* species occur in Michigan; *S. perfoliatum* (cup plant) has square stems and connate leaf bases; *S. integrifolium* (rosinweed) has opposite, entire cauline leaves, and *S. terebinthinaceum* (prairie-dock) has unlobed basal leaves. All four *Silphium* species are concentrated in southern Lower Michigan.

**Best survey time/phenology:** In Michigan, compass plant flowers in July through September, and fruits in August and September. Although compass plant is most conspicuous during its flowering period, the species can be identified by its distinctive large, deeply lobed basal leaves throughout the growing season from May through late September. The leaves blacken in fall.

**FQI Coefficient and Wetland Category:** 9, UPL

**Habitat:** Throughout its range, compass plant is characteristic of prairie habitats. In Michigan, all populations of the species occur in degraded railroad rights-of-way or along roadsides, often with few native associates. At least some of these populations are thought to be adventive (Voss 1996). Associates in the few degraded prairie sites where the species is presumably native include *Achillea millefolium* (yarrow), *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indian hemp), *Asclepias verticillata* (whorled milkweed), *Dodecatheon meadia* (shooting star), *Euphorbia corollata* (flowering spurge), *Hierochloa odorata* (sweet grass), *Monarda fistulosa* (wild bergamot), *Ratibida pinnata* (yellow coneflower), *Rubus flagellaris* (northern dewberry), *Schizachyrium scoparium* (little bluestem), *Silphium terebinthinaceum* (prairie dock), *Solidago rigida* (stiff goldenrod), and *Sorghastrum nutans* (Indian grass). Due to fire suppression and repeated disturbances, trees, shrubs, and aggressive non-native herbaceous species are the most common associates at several sites.

Compass plant is more common west of Michigan. In the Chicago region, compass plant is locally common in prairies, where it occurs with big bluestem, *Aster laevis* (smooth aster), *Calystegia sepium* (hedge bindweed), *Comandra umbellata* (bastard toadflax), *Eryngium yuccifolium* (rattlesnake-master), *Dalea purpurea* (purple prairie-clover), flowering spurge, *Hypoxis hirsuta* (yellow star-grass), *Lespedeza capitata* (round-headed bush-clover), *Lithospermum canescens* (hoary

puccoon), *Parthenium integrifolium* (wild quinine), yellow coneflower, *Silphium integrifolium* (rosinweed), prairie dock, stiff goldenrod, Indian grass, *Sporobolus heterolepis* (prairie dropseed), and *Stipa spartea* (porcupine grass) (Swink and Wilhelm 1994).

**Biology:** Compass plant is well-known for the north-south vertical orientation exhibited by its lower leaves, primarily the basal leaves of non-flowering plants. Basal leaves and lower cauline leaves exposed to directional sunlight orient over a 2-3 week period of expansion. Development of compass orientation may result from the stimulation of photosensitive cells on the surfaces of the leaf or petiole that respond to morning sunlight (Zhang et al. 1991). Sessile leaves or leaves with short petioles are oriented at random, indicating the importance of petiole torsion in orienting the lower, longer-petioled leaves. The compass orientation of the leaves increases water use efficiency, likely an adaptation to the drought-prone prairie environment (Jurik et al. 1990). The deep, fleshy tap roots exhibited by this species are also likely an adaptation to drought, and may be responsible for its survival and even flowering during severe drought (Weaver et al. 1935, Weaver 1958, Martin et al. 1991).

**Conservation/management:** Michigan is at the northeastern edge of the native range of compass plant, and the species was presumably never common in the state. Fragmentation and conversion of prairie and open savanna habitats to agricultural and urban land following European settlement has further reduced the presence of the species in the state. All extant or recently extant populations of compass plant in Michigan occur in railroad rights-of-way or along roadsides, where the plants are vulnerable to bulldozing, mowing, plowing, herbicide use, and other anthropogenic disturbances. Frequent disturbance has reduced or eliminated native associates at several sites, and allowed invasion of most sites by several aggressive, non-native species, including *Agrostis gigantea* (redtop), *Berteroa incana* (hoary alyssum), *Bromus inermis* (smooth brome), *Centaurea maculosa* (spotted knapweed), *Daucus carota* (Queen-Anne's-lace), *Hypericum perforatum* (spotted St. John's-wort), *Melilotus alba* (white sweet-clover), *Poa compressa* (Canada bluegrass), *P. pratensis* (Kentucky bluegrass), *Saponaria officinalis* (bouncing bet), and *Trifolium repens* (white clover). Fire suppression and lack of management has further contributed to the decline of compass plant by fostering



an increase in shrub and tree cover in formerly open habitats. Dense clones of *Rhus typhina* (staghorn sumac) have degraded or eliminated several former prairie sites in railroad rights-of-way.

Long-term protection of compass plant in Michigan requires management of remaining habitat to provide open conditions required by the species. Use of prescribed fire, manual removal of trees and shrubs, and herbicide application targeting invasive herbaceous species are recommended to restore, maintain, and enhance prairie habitats that support this species. Compass plant has been observed at only four of the 13 documented sites since the early 1980s, and none of these sites are being actively managed for the species or its habitat. All remaining populations of compass plant are vulnerable to railroad and roadside maintenance and encroachment of aggressive non-native species. Although deep taproots allow individuals to persist through repeated disturbance events, including plowing, short-distance seed dispersal limits the colonization ability of compass plant, which has implications for recovery of the species in degraded sites and/or introduction of the species to restoration sites or prairie plantings (Pleasants and Jurik 1992). Perhaps the greatest need for conservation of the species in Michigan is identification and management of sites that occur outside railroad and road rights-of-way. Compass plant could also be introduced in prairie restorations that are not likely to be negatively impacted by future development.

**Comments:** Compass plant is host to a community of stem-boring insects and associated parasitoids, including gall wasps (particularly *Antistrophus rufus* and *A. minor*), mordellid beetles, and chalcid wasps (Rathcke 1976a, 1976b, Tooker and Hanks 2004, 2006). Volatile compounds produced by gall-stressed individuals of compass plant appear to attract parasitoids to their hosts, potentially increasing fitness of the host plants (Tooker and Hanks 2006).

Presumed hybrids with *S. terebinthinaceum* (prairie dock) have been noted in Michigan (Menominee and Wayne cos.) and several other states (Fisher 1959, Fisher 1966, Swink and Wilhelm 1994, Voss 1996, Cochrane and Iltis 2000, Molano-Flores 2005). Presumed hybrids are generally characterized by leaves that are intermediate between the species (shallowly to moderately lobed). Some populations of

plants with pinnately lobed leaves but glabrous stems have been referred to *S. pinnatifidum* Elliott, or *S. terebinthinaceum* var. *pinnatifidum*, a primarily southern species that may have evolved following hybridization (FNA Editorial Committee 2006). The genus *Silphium* is derived from the Greek *sylphion*, a resinous African plant species. The specific epithet *laciniatum* translates as “deeply slashed into slender segments,” a reference to the characteristic pinnatifid or bipinnatifid leaves (Antonio and Masi 2001).

**Research needs:** The primary need is an updated status survey at extant and historic locations. Presence/absence and population data were last collected at most sites in the early 1980s. Research on the impacts of fire and other management techniques on populations of compass plant will provide land stewards with methods for maintaining and enhancing populations of the species. Numerous studies have been conducted on the physiology, population biology, and autoecology of the species.

**Related abstracts:** Bur oak plains, dry-mesic prairie, mesic prairie, oak openings, Jacob’s ladder, leadplant, prairie coreopsis, prairie dropseed, purple milkweed, shooting-star, blazing star borer, culver’s root borer, leadplant flower moth, silphium borer

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- Abstract citation:**
- Slaughter, B.S. 2009. Special Plant Abstract for compass plant (*Silphium laciniatum*). Michigan Natural Features Inventory, Lansing, MI. 4 pp.

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Funding for abstract provided by the Michigan Department of Transportation.

