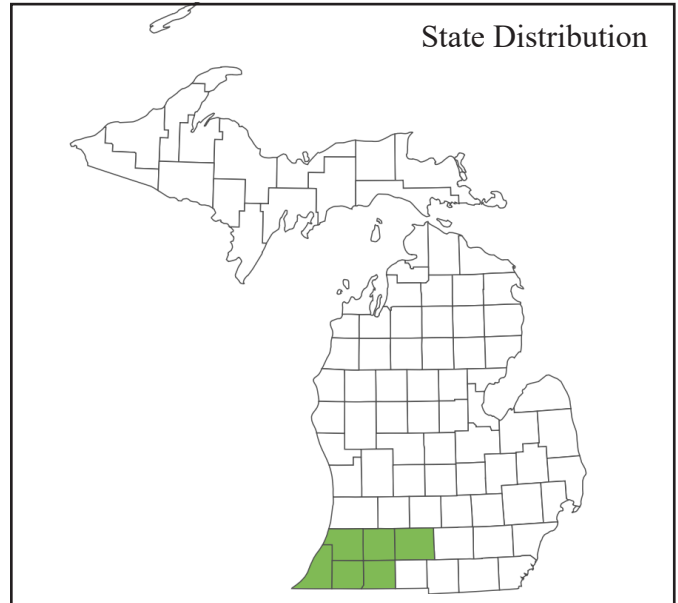
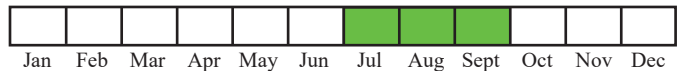




Photo by Ryan P. O'Connor



Best Survey Period



Status: State endangered

Global and state rank: G5/S2

Other common names: button eryngo, button snakeroot

Family: Apiaceae (Carrot family)

Taxonomy: This is the only species native to Michigan in the genus *Eryngium*. French botanist Andre Michaux named the plant *Eryngium yuccifolium* in 1803 (Trent 1938). The specific epithet *yuccifolium* is in reference to leaves that look like species in the genus *Yucca*. Two varieties of this species exist in the United States – *Eryngium yuccifolium* Michx. var. *synchaetum* A. Gray ex J.M. Coult. & Rose and *Eryngium yuccifolium* Michx. var. *yuccifolium* Michx. (Integrated Taxonomic Information System). *Eryngium yuccifolium* Michx. var. *yuccifolium* Michx. is the typical variety throughout most of its range, including in Michigan.

Total range: Rattlesnake-master ranges from Texas to Minnesota, east to Connecticut and Florida. It is listed as SH (Possibly Extirpated) in Maryland, S1 (Critically Imperiled) in Nebraska, S2 (Imperiled)

in Michigan and Virginia, S3 (Vulnerable) in Ohio and Minnesota, and secure or unranked in Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, New Jersey, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Wisconsin (NatureServe 2023).

State distribution: Rattlesnake-master is known from 32 occurrences in six counties in southern lower Michigan, with the vast majority in southwest Michigan. It occurs primarily in the Southern Lower Peninsula Hills and Plains ecoregion, which is a heterogeneous mix of glacial hilly and rolling landscapes (Albert 1995).

Many restoration plantings have resulted in populations throughout southern lower Michigan, as this species is common in prairie seed mixes and plantings (Reznicek et al. 2011, Prairie Moon Nursery 2023, Wildtype Native Plant Nursery 2023). These instances often occur in counties outside of the historical range of rattlesnake-master and are not considered native.

Recognition: Rattlesnake-master is a tall perennial



forb (1m or more) of prairies, savannas, and fens. It has alternately arranged sessile linear blue-green leaves that can be up to 100 cm long and 3 cm wide, with widely spaced narrow, elongated spines along the margins (Fisher 1989, Gleason and Cronquist 1991, Yatskievych 2006). Unlike most dicots, the leaves have parallel veins similar to those of the *Yucca* plant, hence the specific epithet (Swink and Wilhelm 1994).

Individual flowers are white, sessile, borne in several distinct globose heads (1--2.5 cm long) atop tall peduncles (inflorescence stalks) and subtended by a bract (Gleason and Cronquist 1991). Each flower has five white petals and five greenish sepals. Flowers have two protruded styles, two carpels, and five stamens. One plant can have one to over 10 inflorescence stalks, each stalk consisting of 10--40 compact inflorescence heads (Molano-Flores 2001). Fruits are 8--10 mm long, oblong, and have ascending, papery scales (Yatskievych 2006).

This species is unlikely to be confused for any other native species. One other *Eryngium* species, blue eryngo (*E. planum*), has been documented in Michigan as an escaped garden perennial of Eurasian origin, which was first collected in 1917 in Washtenaw County. *Eryngium planum* is easily distinguished by its netted-veined leaves and flower bracts more than half as long as the blue (not white) flowering head.

Best survey time/phenology: This species flowers from early July through late September. The distinct leaf shape allows for detection during a longer survey period, as early as May when leaves emerge. The period of flowering lasts approximately one month, and the flowering is temporally dioecious, meaning that there is a lag between the pistillate and staminate phases. This adaptation maximizes outcrossing and may be the cause of high fruit set (Molano-Flores 2001).

Habitat: Rattlesnake master primarily occurs in mesic to wet-mesic, open, sedge- and grass-dominated portions of prairies, savannas, and

fens (MNFI 2023). Open habitat is required for population persistence of this species. As these habitats experience succession via shrub and tree encroachment, invasive species, and improper management including lack of fire and pesticide use along powerline and railroad rights-of-way, available habitat for this species decreases and some populations have disappeared due to habitat conversion (MNFI 2023).

Most extant occurrences are found in degraded remnant prairies and savannas. The most frequent natural communities in which rattlesnake is found include dry-mesic prairie, wet-mesic prairie, wet-mesic sand prairie, mesic prairie, mesic sand prairie, oak barrens, oak openings, and prairie fen (MNFI 2023).

A large proportion of these populations occur along road and railroad rights-of-way. This is often the case for prairie plants because railroad rights-of-way were never plowed for agriculture, and experienced occasional wildfires caused by sparks from trains (Chapman and Brewer 1998). The abandonment of railroads over the last 60 years has resulted in invasion by canopy species and degradation of prairie habitat (Harrington and Leach 1989).

Populations outside of the historical range of rattlesnake-master are not treated as native occurrences (Reznicek et al. 2011). These occurrences are often the result of prairie restoration seeding. The same is true of populations within the historical range that are clearly planted (e.g., occurring in locations that never supported suitable habitat, in locations that were severely degraded followed by restoration efforts, or with prairie-planting indicator species such as purple coneflower (*Echinacea purpurea*, State Extirpated).

Associated plants include *Achillea millefolium* (yarrow), *Andropogon gerardii* (big bluestem), *Baptisia lactea* (white false indigo), *Coreopsis tripteris* (tall tickseed), *Euphorbia corollata* (flowering spurge), *Monarda fistulosa* (wild-bergamot), *Quercus velutina* (black oak), *Rubus*



flagellaris (northern dewberry), *Solidago juncea* (early goldenrod), *Tradescantia ohiensis* (spiderwort), *Vernonia missurica* (Missouri ironweed), and *Zizia aurea* (golden Alexanders) (MNFI 2023).

Biology: *Eryngium yuccifolium* is an herbaceous perennial plant. Molano-Flores (2001) found that this species is a xenogamous (cross-pollinating) species with temporal dioecism, a flowering sequence that reduces overlap between the pistillate and staminate phases of an individual plant. This strategy allows pollen to be shed before any stigma becomes receptive, minimizing self-pollination and maximizing outcrossing. This adaptation is common among species within the Apiaceae. Rattlesnake-master requires a month from the time when flower buds open to when all stigmas become receptive (Molano-Flores 2001). Asexual reproduction has not been documented in this species (Molano-Flores 2001).

Eryngium yuccifolium also exhibits multiple flower heads per inflorescence (10 – 40), which are visited by generalist pollinators such as small bees, bumblebees, flies, wasps, butterflies, and moths. Danderson and Molano-Flores (2010) counted six orders and 33 families of insects, primarily flies, bees, and beetles, visiting the inflorescences. An earlier study documented high levels of herbivory by the larva of a Gelechiidae moth (*Aristotellia* sp.), which significantly damaged the flowers and fruits (Molano-Flores 2001). Floral herbivory by the moth *Coleotechnites eryngiella* has been shown to damage flowers, turning them brown, and to reduce flower size, leading to reduced flower visitation by pollinators (Danderson and Molano-Flores 2010).

Rattlesnake master seed requires at least 12 weeks of moist, cold stratification to break dormancy. One study from Illinois found high seed set (almost 90%) for this species (Molano-Flores 2001), but a more recent study had germination rates below 50% (Riebkes et al. 2015). The duration of this latter study also showed that seeds can remain viable after 2-3 years, but information on the

longevity of the seed bank beyond this amount of time is lacking.

Conservation/management: Rattlesnake-master populations thrive best in areas with full sun. Extant occurrences in Michigan are found in small patches of remnant prairie and prairie fen, and remnants of oak barrens and other savannas. This species was undoubtedly much more common and wide-ranging prior to European colonization and has suffered severe impacts because of the conversion of grasslands in Michigan for agriculture and other anthropogenic uses. There are currently 17 extant populations and 15 populations designated as failed to find, unrankable, historical, or extirpated. Historical observations have not been visited recently, and these EOs usually lack detailed spatial data. In addition, eight of the known extant populations have not been surveyed since 1990, so there is not an updated rank, and it is possible for some of these to have been extirpated (MNFI 2023).

In addition, the loss of landscape and anthropogenic processes that maintained these communities, such as natural wildfires and the use of fire as a management tool by Native Americans, has ultimately led to canopy closure where habitat was not converted or destroyed. Despite protection by a land conservancy, two colonies in Berrien County have experienced declines in population numbers due to encroachment from shrubs like red osier (*Cornus sericea*) and black alder (*Alnus glutinosa*) which grow along the adjacent creek (MNFI 2023). Allowing shrub and tree succession to occur has resulted in the decline or extirpation of several documented populations. Rattlesnake-master has thus generally been restricted to small remnants in former prairie-savanna regions, including disturbed grasslands and openings along roadsides and other types of rights-of-way where it is unlikely to be viable over the long term.

Other documented causes of extirpation and population decline include housing construction, abandonment of railroad right-of-way management, mowing and pesticides. Land development is a



threat to this and other prairie species. Impacts to populations should be avoided if at all possible. If projects are anticipated to impact populations, mitigation measures should be taken such as transplanting, re-seeding, or habitat improvements elsewhere. Several populations are surrounded by incompatible land uses such as railroad tracks, farm fields, residential home construction and industrial development. Several relatively large populations are located within non-linear remnants, primarily prairie fen, and also within a wet-mesic prairie and an oak barrens. Nine extant populations are within road, railroad, or utility rights-of-way (MNFI 2023)

Permanent conservation of habitat containing extant populations is important for species viability. Only three known populations have been permanently protected as nature preserves by The Nature Conservancy, Michigan Nature Association, and Michigan Audubon. These populations and those on MDOT rights-of-way are good candidates for management in the form of prescribed fire and invasive species treatment. A large proportion of extant populations are found only on narrow railroad or utility rights-of-way which are bordered by private lands (MNFI 2023). Conservation of this species will require working with private and public landowners on management and protection.

Comments: Rattlesnake-master is a common component of prairie seed mixes, and as such has expanded outside of its native range into prairie and savanna restorations. Currently, over 20 websites list this species' seed for sale. Land managers, especially those working within the native range, should keep detailed records including seed mix ingredients in order to identify planted populations in the long-term.

The fibers in the leaves of rattlesnake-master have long been used by Indigenous cultures in North America for a variety of purposes, such as cordage and footwear (Trent 1938, Kuttruff et al. 1998). Indigenous cultures also used this plant medicinally as a diuretic, emetic, sedative, analgesic, and tonic (Taylor 1940, Moerman 2013). The common names

rattlesnake-master and button snakeroot are in reference to the plant's use as a snakebite remedy (Yatskievych 2006). Seven tribes have specifically referred to *Eryngium* (usually its root) as an anti-venom (Price 2016).

Research needs: Older records with extant populations should be re-surveyed to document trends and management activities; where possible, document instances of introduction via prairie restoration seeding. Genetic studies may be able to determine native vs. planted populations and screen for non-native populations within the native range. Explore conservation options with private landowners to protect and manage populations on private lands. Because some populations have been apparently extirpated due to woody encroachment, the longevity of seeds in the seedbank should be explored. Depending on seed longevity, reversing woody encroachment at certain sites may allow for the possibility of successful recruitment via the seedbank.

Related abstracts: dry sand prairie, dry-mesic prairie, mesic prairie, mesic sand prairie, oak barrens, oak openings, prairie fen, wet-mesic prairie, wet-mesic sand prairie, downy sunflower, leadplant, shooting star, sweet coneflower, violet wood sorrel, white gentian, Blanding's turtle, blazing star borer, dickcissel, Eastern box turtle, Eastern massasauga rattlesnake, grasshopper sparrow, gray rat snake, Henslow's sparrow, Kirtland's snake, prairie vole, regal fritillary, short-eared owl, spotted turtle, Sprague's pygarcia.

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