Rudbeckia fulgida var. *fulgida*

Orange Coneflower

Asteraceae

Rudbeckia fulgida var. *fulgida* by Alan Weakley, 2020

Rudbeckia fulgida var. *fulgida* Rare Plant Profile

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

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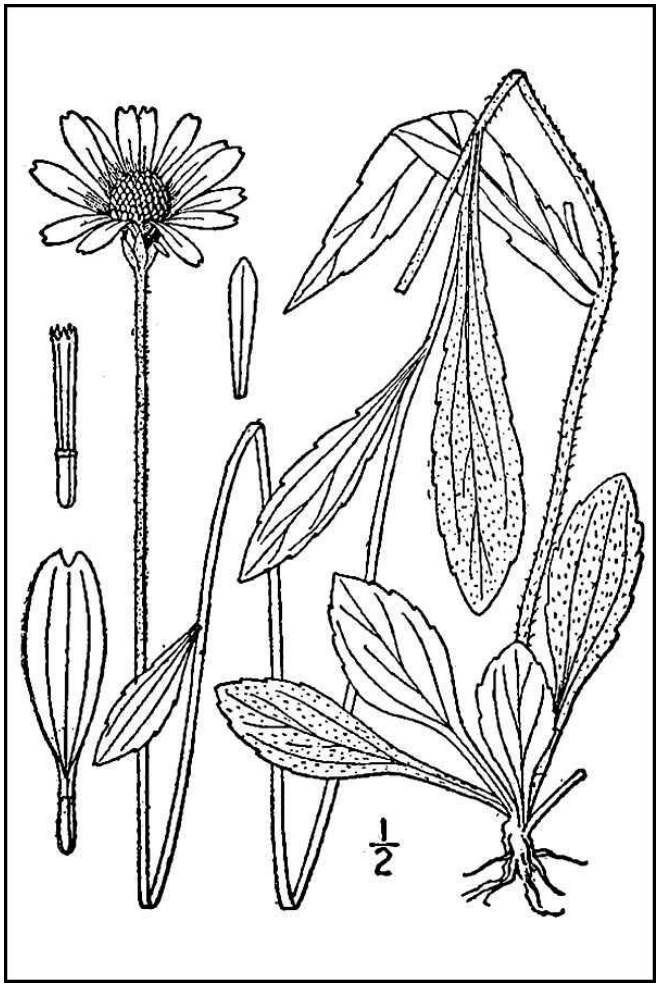
Life History

Rudbeckia fulgida var. *fulgida* (Orange Coneflower) is a rhizomatous perennial herb in the Asteraceae. The species reproduces clonally by short stolons so it often grows in clumps. The plants develop from basal rosettes with lance-shaped leaves that are 3–11 cm long and 2–4.5 cm wide: The leaf lengths are proportionally three or more times greater than the widths. The flowering stems are hairy and range from 0.5–1.5 meters in height. The stem leaves are similar to the basal leaves but gradually become smaller toward the top of the stem. The margins of both basal and stem leaves can be entire or toothed and the surfaces may be smooth or hairy. Individual *R. fulgida* var. *fulgida* plants may be single flowered or have branching stems. The flowers are composite heads of both ray and disc florets that form on the ends of long peduncles. Bracts of the inflorescence are 1–2.2 cm long and hairy. Orange Coneflower heads have 8–14 yellow-orange ray florets that are 8–20 mm in length and numerous purple-brown disc florets. The small bracts at the bases of the disc florets are smooth-sided with ciliate margins. All of the florets are fertile, but the ray flowers are pistillate and the disc flowers are bisexual. (See Britton and Brown 1913, Fernald 1950, Kral 1975, Gleason and Cronquist 1991, Campbell and Seymour 2013, Urbatsch and Cox 2020).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: John Sims, 1818.



Left and Center: Dwayne Estes, 2018. Right: Alan Weakley, 2020.

The basal rosettes of *Rudbeckia fulgida* can persist through the winter (NCCE 2023). Tufts of new leaves are produced at the tips of short stolons that develop during the growing season (Campbell and Seymour 2013, Les 2017). The stolons later thicken and become rhizomatous (Kral 1975). Plants maintained in a greenhouse were primarily dormant during winter months but once the days reached lengths of 12+ hours the flat leaves of young winter rosettes became more upright and initiated vigorous growth (Perdue 1959). *Rudbeckia fulgida* typically blooms between August and October (Hough 1983, Weakley et al. 2022); in New Jersey the plants have usually been found in flower during September (NJNHP 2022). Rollings and Goulson (2019) indicated that the flowering period can last for up to 12 weeks.

Three sections are recognized within the genus *Rudbeckia*, and *R. fulgida* is included in section *Rudbeckia* (Urbatsch and Cox 2020). Other species in the section that occur in New Jersey include *R. hirta*, *R. laciniata*, and *R. triloba*. Perdue (1957, 1959) observed that species in section *Rudbeckia* were quite distinct and showed no evidence of hybridization, and more recent cross-pollination experiments reported extremely low levels of crossability within the group Palmer et al. 2009). Although seven natural varieties of *Rudbeckia fulgida* have been described, var. *fulgida* is set apart by the shape of its basal leaves—all of the other *R. fulgida* subtaxons have leaves that are less than three times longer than wide (Perdue 1957). An assortment of horticultural varieties have also been developed.

Pollinator Dynamics

Many insects can serve as pollinators for *Rudbeckia fulgida* var. *fulgida* but the most important ones are probably bees. Different portions of *Rudbeckia* ray florets absorb and reflect ultraviolet (UV) light, creating patterns that cannot be detected by the human eye but enhance visibility to insects. The patterns vary between species. In *Rudbeckia fulgida*, the inner half of a ray floret is UV absorbent while the outer half is UV reflective, creating a bold, dark ring around the center of the floral head (Abrahamson and McCrea 1977, McCrea and Levy 1983, Horth et al. 2014). The flowers are highly attractive to insects, drawing in a wide array of bees, wasps, flies, and butterflies (Leopold 2005, Wu 2012, Horth et al. 2014, Palmersheim et al. 2022), even in locations where the species is not native (Rollings and Goulson 2019). Wu (2012) thought that the presence of large spiders and their webs might deter potential pollinators of *Rudbeckia*

fulgida and compared insect activity on flowers where Yellow Garden Spiders (*Argiope aurantia*) were present or absent. No significant effect of the presence of *A. aurantia* and/or webs on the visitation time of pollinating insects was reported.

The Coneflower Mining Bee (*Andrena rudbeckiae*) is a specialist bee native to New Jersey that collects pollen exclusively from *Rudbeckia* species (Fowler 2016), and more than two dozen other bee species that specialize on composite flowers have been documented on various kinds of *Rudbeckia* (Fowler and Droge 2020). Halictid bees (also known as sweat bees) are often particularly abundant on *Rudbeckia* flowers (Horth et al. 2014, Erickson et al. 2021). Pollinator studies of *Rudbeckia* often use horticultural varieties, and information gleaned from research on cultivars may not always be applicable to native plants (Grant 2019). However, a comparison of pollinator activity between *Rudbeckia fulgida* var. *fulgida* and *R. fulgida* var. *sullivantii* 'Goldsturm' found that both were primarily pollinated by native bees and flies, and no pollinator group showed a significant preference for either the native plants or the cultivars (White 2016).

Very low levels of self-compatibility have been reported for *Rudbeckia fulgida*, and few viable seeds resulted from either experimental self-pollinations or crosses with closely related taxa (Palmer et al. 2009). Some polyploidy has been found in *R. fulgida* var. *fulgida*—examination of material from multiple locations revealed that some populations are diploid and some are tetraploid (Perdue 1959).

Seed Dispersal and Establishment

Rudbeckia fulgida flowers have 8–14 ray florets and 50–500 disc florets, each of which can produce one dry, single-seeded fruit. The fruits are dark-gray, four-angled, and 2–4 mm long. Fruits of many species in the Asteraceae have feathery bristles that facilitate wind dispersal but those are not present in *R. fulgida* (Kral 1975, Urbatsch and Cox 2020). Seed set in natural populations usually exceeds 45% (Les 2017). The fruits can remain in the dry seedheads well into the winter months. Some may be dispersed locally via gravity but many are likely to be eaten by birds (Bebeau 2014, CCE 2023, NCCE 2023) and thus distributed farther. Even birds that are primarily predators rather than dispersers of seeds occasionally excrete viable propagules (Heleno et al. 2011). Most of the birds that consume *Rudbeckia* seeds during the winter are resident species, limiting the probable dispersal distances.

Rudbeckia fulgida was reported to germinate within 2–6 days of planting (Fay et al. 1993, Bond 2010) but neither study utilized freshly collected seed. Fresh seeds usually require 2–3 months of cold stratification in order to germinate (Bebeau 2014, CCE 2023). Germination is highest at temperatures between 28.3 and 32.6ºC, with 30ºC being optimal (Fay et al. 1993). Wetting of *R. fulgida* seeds improved germination rates in a controlled setting (Bond 2010). The studies suggest that both temperature and moisture may play a part in triggering seedling emergence in the wild.

Mycorrhizae have been documented in *Rudbeckia fulgida*, but only in limited amounts (Les 2017). *R. fulgida* roots have a hypodermis that contains a mixture of two cell types: The majority of the cells have a protective coating but they are interspersed with unprotected cells

(passage cells) that permit the entry of water and ions. Mycorrhizal fungi can only access the inner cortex of the roots through passage cells. If the plants can vary the proportion of passage cells in response to environmental cues it may allow them to control the rate of fungal colonization (Sharda and Koide 2008, Sharda 2009).

Habitat

Rudbeckia fulgida var. *fulgida* can thrive in a broad array of conditions that range from wet to dry, acid to alkaline, and sunny to shady (Les 2017, Urbatsch and Cox 2020). The species can even tolerate a certain amount of salinity (Les 2017). Moist soils and full sun to partial shade are generally recommended for cultivation of *R. fulgida* (Leopold 2005, NCCE 2023). *Rudbeckia fulgida* var. *fulgida* has been found at elevations of 0–700 meters above sea level (Les 2017, Urbatsch and Cox 2020). It is most frequently reported in open sites such as meadows, prairies, and fens (Rhoads and Block 2007, Johnson and Walz 2013, England 2014, Weakley et al. 2022). Ruch et al. (2002) described one Indiana community as an old field that had been enhanced with prairie plantings. The habitat of another Indiana population was described as mature woodland (Hubini et al. 2017) but in most cases wooded habitats are relatively open or the coneflower occurs within gaps or glades (Kral 1975, Les 2017). In a Michigan fen, burning to control the spread of invasive shrubs appeared to favor the proliferation of *R. fulgida* (Summerville and Clampitt 1999). *R. fulgida* var. *fulgida* has also been known to grow on disturbed sites such as roadsides (Kral 1975, Campbell and Seymour 2013).

The habitats of historic New Jersey occurrences of *Rudbeckia fulgida* var. *fulgida* were described as meadows, fields, or roadsides. The extant population is situated at the edge of a limestone fen (NJNHP 2022). Breden et al. (2001) listed *R. fulgida* as a characteristic species of pasture fen, a *Juniperus virginiana* / *Dasiphora fruiticosa* ssp. *floribunda* / *Carex flava—Carex tetanica* Shrub Herbaceous Vegetation association. Such communities have often been shaped by grazing, and they are considered rare both globally and in the state (G1G2/S1S2). Some examples of open prairie community types where *R. fulgida* var. *fulgida* has been found in Georgia include *Sorghastrum nutans - Ratibida pinnata - Houstonia nigricans* communities and *Andropogon gerardii - Sorghastrum nutans* communities (Echols and Zomlefer 2010).

Wetland Indicator Status

The U. S. Army Corps of Engineers divided the country into a number of regions for use with the National Wetlands Plant List and portions of New Jersey fall into three different regions (Figure 1). *Rudbeckia fulgida* has more than one wetland indicator status within the state. In the Northcentral and Northeast region, *R. fulgida* is an obligate wetland species, meaning that it almost always occurs in wetlands. In other parts of the state it is facultative, meaning that it occurs in both wetlands and nonwetlands (U. S. Army Corps of Engineers 2020).

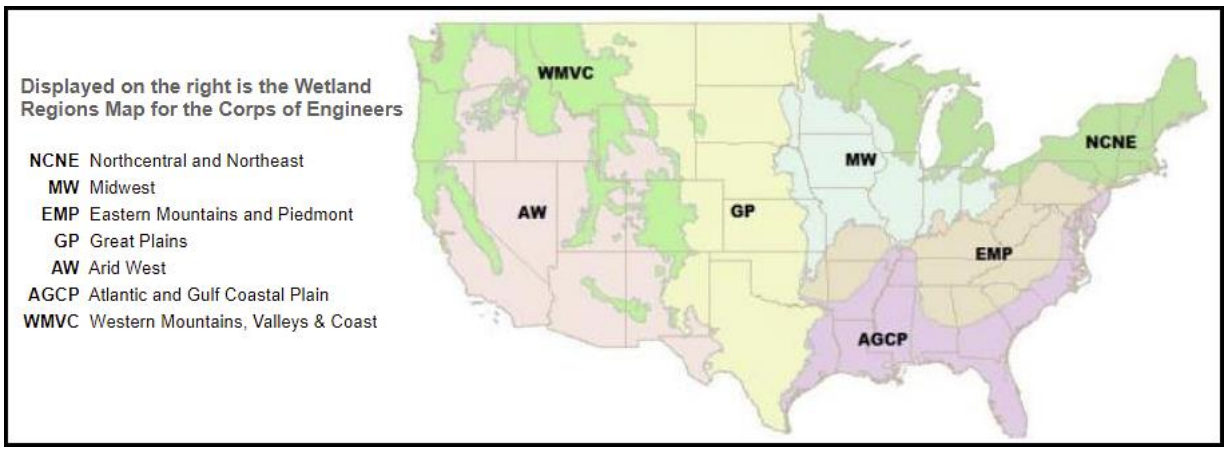


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2023b)

RUFUF

Coefficient of Conservatism (Walz et al. 2018)

CoC = 5. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

Rudbeckia fulgida var. *fulgida* is native to the eastern United States and it has been introduced in scattered locations throughout Europe and Asia (POWO 2023). The map in Figure 2 depicts the extent of Orange Coneflower in North America.

The USDA PLANTS Database (2023b) shows records of *Rudbeckia fulgida* var. *fulgida* in three New Jersey counties: Hunterdon, Somerset, and Sussex (Figure 3). The data include historic observations and do not reflect the current distribution of the species. *R. fulgida* var. *fulgida* was also historically known from Cumberland County (Moore et al. 2016).

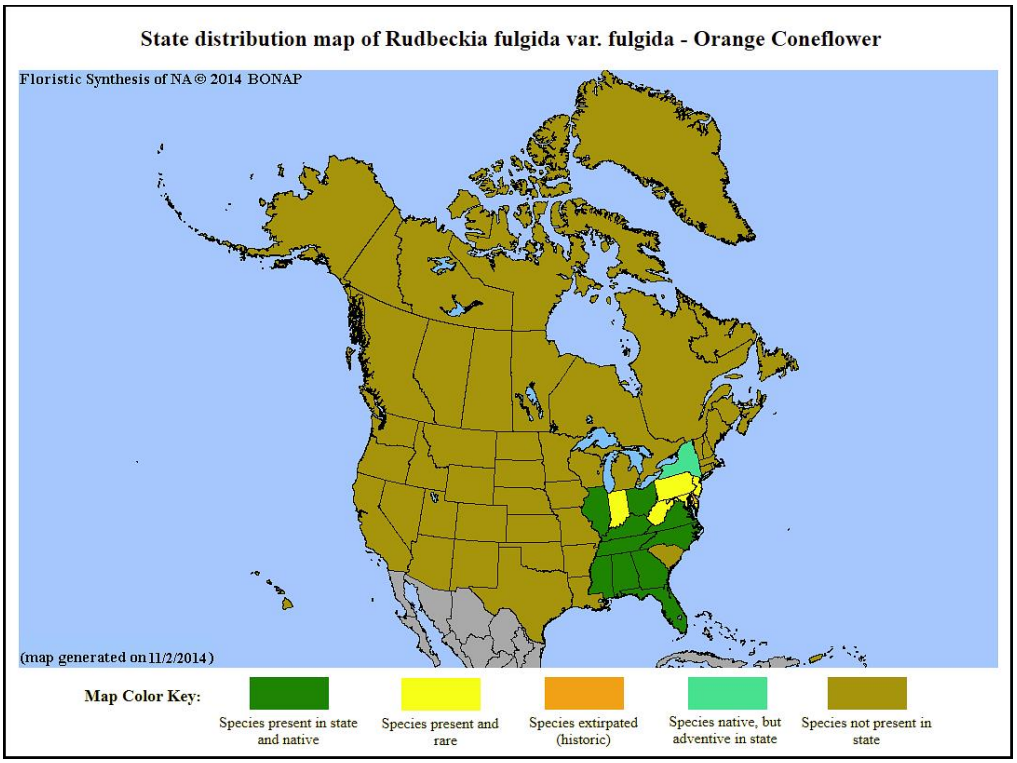


Figure 2. Distribution of R. fulgida var. fulgida in North America, adapted from BONAP (Kartesz 2015).

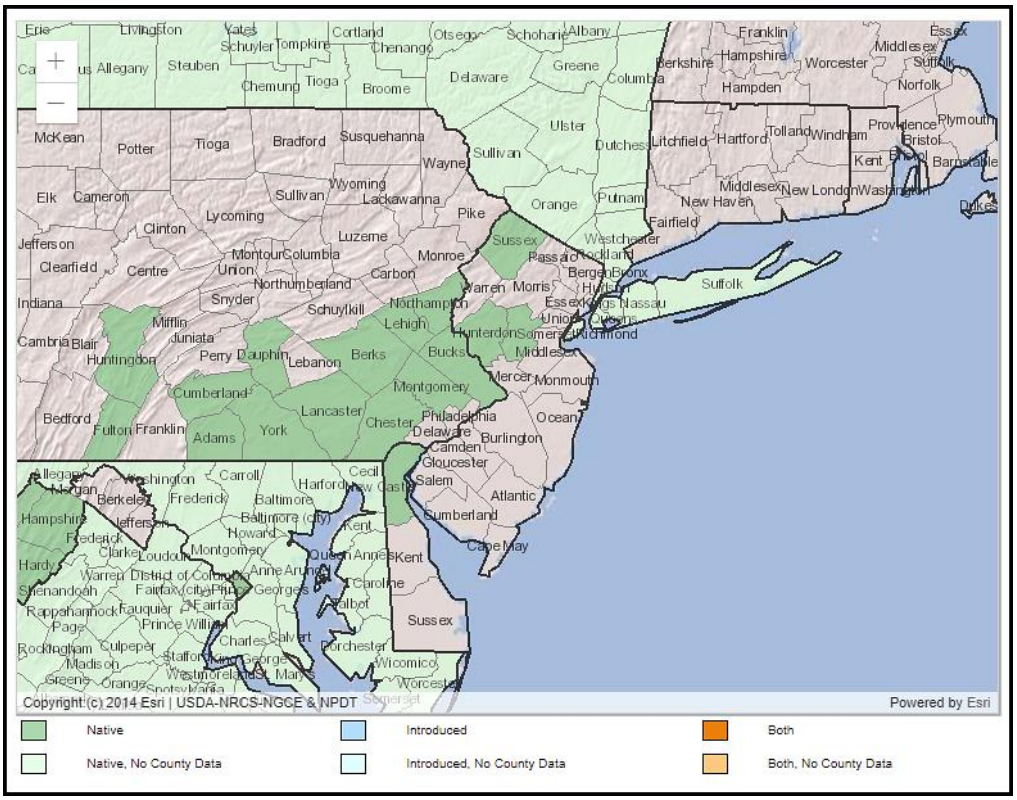


Figure 3. County records of R. fulgida var. fulgida in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

The global rank of *Rudbeckia fulgida* var. *fulgida* is G5T4?, meaning that it is apparently secure at a global scale. The T4 rank means the variety is at fairly low risk of extinction or collapse due to an extensive range and/or many populations or occurrences although there is some cause for concern as a result of recent local declines, threats, or other factors. The question mark indicates some uncertainty regarding the status of Orange Coneflower, which is noted to be due for a review (NatureServe 2023). The map below (Figure 4) illustrates the conservation status of *Rudbeckia fulgida* var. *fulgida* throughout its native range. The coneflower is vulnerable (moderate risk of extinction) in two states, imperiled (high risk of extinction) in one state, critically imperiled (very high risk of extinction) in one state, and possibly extirpated in Delaware. In most of the other states where it has been found *R. fulgida* var. *fulgida* is secure, apparently secure, or unranked. Occurrences in New York are thought to be outside of its native range.

In the North Atlantic region of North America, which includes four Canadian provinces and twelve U. S. states, *Rudbeckia fulgida* var. *fulgida* has been identified as a plant species of highest conservation priority. The species has a regional rank of R3 (vulnerable), signifying a moderate risk of regional extinction (Frances 2017).

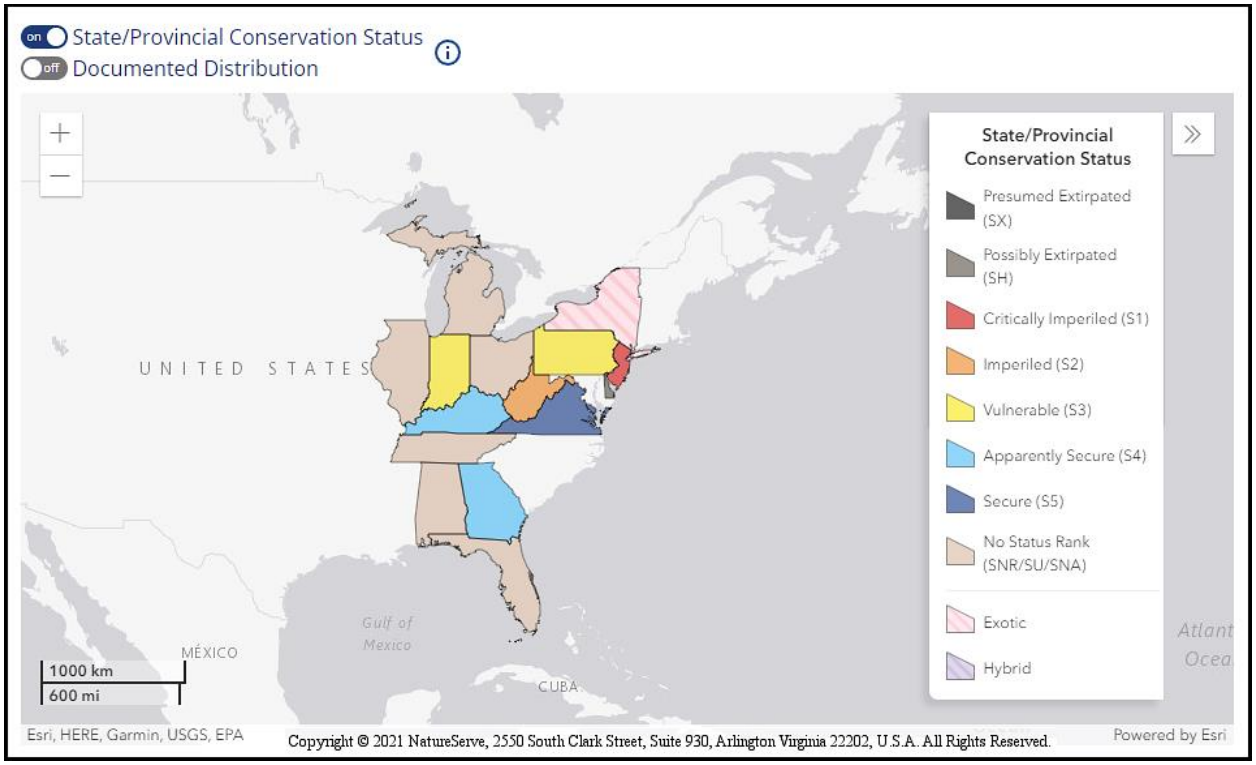


Figure 4. Conservation status of R. fulgida var. fulgida in North America (NatureServe 2023).

New Jersey is the state where *Rudbeckia fulgida* var. *fulgida* is critically imperiled. The S1 rank signifies five or fewer occurrences in the state. A taxon with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. Orange Coneflower is also listed as an

endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to *R. fulgida* var. *fulgida* signify that the coneflower is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

The first documented *Rudbeckia fulgida* population in New Jersey was located in Hunterdon County (Britton 1889, Keller and Brown 1905) and a second site was found in Somerset County shortly thereafter (Taylor 1915). Additional occurrences were later reported in both counties (Snyder 1984, NJNHP 2022), but by 1998 only one population was considered extant in each (Breden et al. 2006). All of those occurrences are now thought to be historical or extirpated. The state's sole existing population of *R. fulgida* is situated in Sussex County, but habitat at the site is degraded and a critical decline in the colony has been reported (NJNHP 2022).

Threats

In 2006, New Jersey's remaining occurrence of *Rudbeckia fulgida* var. *fulgida* was noted as being in urgent need of management. The habitat was initially degraded by the passage of heavy equipment that created deep ruts in the fen, and the native community at the site has subsequently become threatened by the encroachment of native woody vegetation along with an assortment of invasive plants including *Elaeagnus umbellata*, *Rosa multiflora*, and *Microstegium vimineum*. The reasons for the species' disappearance from other locations in the state where it was once abundant are undetermined (NJNHP 2022).

In some parts of its range, *Rudbeckia fulgida* var. *fulgida* may be parasitized by another native plant. Orange Coneflower often co-occurs with the hemiparasite *Agalinis auriculata* (Ear-leaf False Foxglove) and was found to be a suitable host in greenhouse tests conducted by Cunningham and Parr (1990). However, *Agalinis auriculata* is even rarer than *R. fulgida* var. *fulgida*: The hemiparasite is globally vulnerable (G3) and listed as extirpated in New Jersey (NJNHP 2022, NatureServe 2023).

Rudbeckia plants are subject to an assortment of fungal, bacterial, and viral infections. During the course of an evaluation of *Rudbeckia* cultivars for landscape adaptability one *R. fulgida* cultivar became infected with a *Rhizoctonia* root and stem rot which killed half of the plants (Fulcher et al. 2003). Disease is generally noted to be infrequent in the genus but pathogenic activity increases when the plants are subjected to excess moisture on the leaves (CCE 2023). *Rudbeckia* species are also susceptible to several types of rust fungi that use *Carex* species as alternate hosts, and when the *Rudbeckia* plants co-occur with the alternate hosts the infections can be severe (PSE 2023).

In New Jersey, *Rudbeckia fulgida* var. *fulgida* is likely to be browsed by deer. However, Orange Coneflower plants appear to be moderately tolerant of deer herbivory (NCCE 2023). DeGroote et al. (2011) found that deer browse on *R. fulgida* was heavy but had minimal impact on overall vigor because the plants regrew rapidly and flowering was not reduced.

Shifting climactic conditions in New Jersey are resulting in higher temperatures, more frequent and intense precipitation events, and increasing periods of drought (Hill et al. 2020). An assessment of the potential effects of climate change on *Rudbeckia fulgida* var. *fulgida* concluded that the species was moderately vulnerable in the state (Ring et al. 2013). Orange Coneflower is reportedly drought resistant and able to withstand high temperatures (Les 2017, NCCE 2023) but more frequent rainstorms could increase the plants' susceptibility to various diseases (CCE 2023). A limited capacity for long-distance dispersal might also reduce opportunities for *R. fulgida* var. *fulgida* to colonize new sites when existing locations become unsuitable.

Management Summary and Recommendations

New Jersey's sole population of *Rudbeckia fulgida* var. *fulgida* does not appear to have been monitored recently despite a reportedly urgent need for habitat management (NJNHP 2022). A site visit is recommended to evaluate the current status of the occurrence and identify specific actions that could be taken to preserve the coneflower plants if they are still present. Updated searches of two historical sites that once supported vigorous populations are also suggested.

It is not clear why *Rudbeckia fulgida* var. *fulgida* is so rare in the eastern United States or what triggered its disappearance from places in New Jersey where it formerly had a strong presence. Available information indicates that the species is able to utilize numerous pollinators, reproduces both sexually and vegetatively, has multiple mechanisms for dispersal, and can thrive in a wide variety of habitats. It is often characterized as easy to grow and propagate (eg. Leopold 2005, NCCE 2023). Long-term conservation of *R. fulgida* var. *fulgida* will require a comprehensive understanding of the factors that limit the coneflower's abundance. Some of the information currently available for Orange Coneflower may have been based on studies of other species, varieties, or cultivars with different attributes or requirements. For example, Les (2017) observed that a seed bank is presumed for *R. fulgida* but it has never been documented by research. More specific data is also needed with regard to establishment requirements, relationships with other plants and fungi, and the susceptibility of the variety to different diseases.

Synonyms

The accepted botanical name of the species is *Rudbeckia fulgida* var. *fulgida* Aiton. Orthographic variants, synonyms, and common names are listed below (ITIS 2023, POWO 2023, USDA NRCS 2023b). Seven varieties of *Rudbeckia fulgida* have been recognized (Urbatsch and Cox 2020, POWO 2023) but some current sources (eg. Weakley et al. 2022) have elevated the other varieties of *Rudbeckia fulgida* to species rank, eliminating the subtaxon designation.

Botanical Synonyms	**Common Names**
Centrocarpha acutifolia Sweet	Orange Coneflower
Centrocarpha chrysomela (Michx.) Sweet	Small Hairy Rudbeckia

Centrocarpha discolor (Pursh) Sweet Common Eastern Coneflower
Rudbeckia acuminata C. L. Boynton & Beadle
Rudbeckia aspera Desf.
Rudbeckia chrysomela Michx.
Rudbeckia discolor Pursh
Rudbeckia foliosa C. L. Boynton & Beadle
Rudbeckia newmanii Loudon
Rudbeckia scabra E. Vilm
Rudbeckia tenax C. L. Boynton & Beadle
Rudbeckia truncata Small

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