

# *Smallanthus uvedalia*

**Bear's-foot**

**Asteraceae**



*Smallanthus uvedalia* by J. S. Dodds, 2020

## ***Smallanthus uvedalia* 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

501 E. State St.  
PO Box 420  
Trenton, NJ 08625-0420

Prepared by:  
Jill S. Dodds  
jsdodds@biostarassociates.com

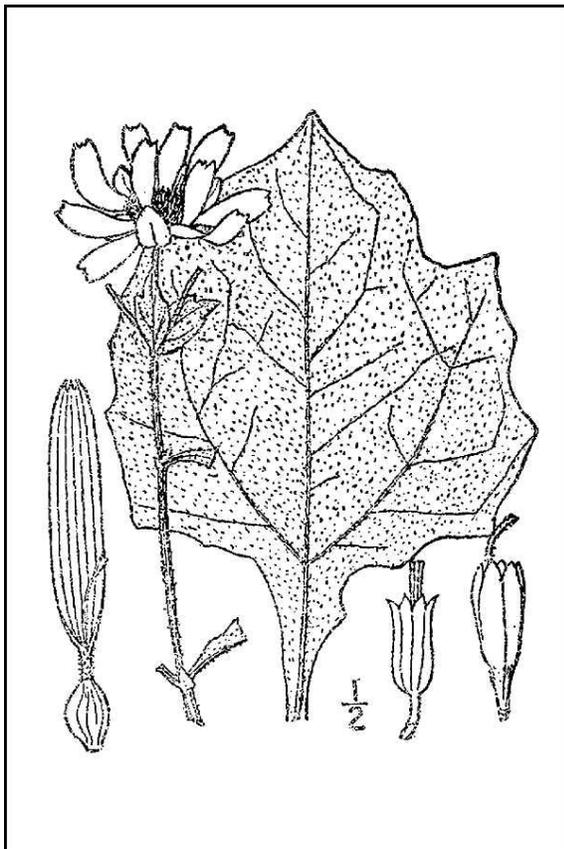
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New Jersey Department of Environmental Protection  
Office of Natural Lands Management  
New Jersey Natural Heritage Program  
natlands@dep.nj.gov

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## Life History

*Smallanthus uvedalia* (Bear's-foot) is a tall perennial herb in the aster family. The stout stems range from 1–3 meters in height and bear large, opposite, palmately-lobed leaves. The upper leaves are nearly stalkless while the lower leaves are narrowed to a winged petiole 3–12 cm in length, and the leaf blades are 10–35+ cm wide and 10-35+(-60) cm long. The composite flower heads of *S. uvedalia* develop on spreading branches and include both ray and disc florets. The dark yellow disc flowers typically number from 40–80 and are functionally staminate, having inferior (basal) ovaries that do not develop and thus resemble little pedicels. The 7–15 ray flowers are bright yellow and fertile. As the ovary at the base of each ray floret ripens its color darkens, changing from white to red to purple to black. (See Fernald 1950, Gleason and Cronquist 1991, Smith 1973, Strother 2020, Weakley 2015, Wells 1965). New Jersey plants typically bloom between July and September (Hough 1983, NJNHP 2022), but Wells (1963) noted that *S. uvedalia* plants in shaded areas are likely to flower later than those growing in open sites. The fruits mature approximately three weeks after flowering begins (Wells 1969).



Left: Illustration by Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Flowering plant, courtesy April Moore, Lady Bird Johnson Wildflower Center.

*Smallanthus uvedalia* has frequently been placed in the genus *Polymnia*, even after *Smallanthus* was described as distinct by Mackenzie (1933) and the separation was reasserted by Robinson (1978). Recent widespread acceptance of *Smallanthus* has resulted in the description and transfer of additional plants so the genus now includes 25 species, most of which occur from

Mexico to South America (Vitali 2014). However, *S. uvedalia* is the only *Smallanthus* known to occur in the United States (Kartesz 2015). Penskar and Crispin (2009) noted that the species is distinctive even when not in flower. Vegetative plants of *Polymnia canadensis* are similar but can be distinguished by their more pinnately-lobed leaves, and the strongly striate fruits of *S. uvedalia* differ from the smoother, three-parted fruits of *P. canadensis* (Britton and Brown 1913, Fernald 1950).



Left: Flower buds by J. S. Dodds, 2020. Right: Fruiting plants, courtesy Stephanie Brundage, Lady Bird Johnson Wildflower Center.

*Smallanthus uvedalia* has a long history of use for medicinal purposes which is likely to continue into the future. Indigenous North Americans from several different cultures used Bear's-foot topically to treat cuts, burns, and skin inflammation; orally for the treatment of indigestion or liver malfunction; and post-childbirth to facilitate placental expulsion (VanDerwarker and Stanyard 2009, Biwer and VanDerwarker 2015). Many of the medicines were concocted from the roots, which are generally fibrous but occasionally become enlarged and somewhat tuberous (Wells 1963). The roots of *S. uvedalia* are rich in fructooligosaccharides, which can provide health benefits that range from enhancing absorption of essential nutrients to reducing the risk of cancer (Moraes et al. 2021). Numerous secondary compounds also occur in the leaves (Craft et al. 2019), some of which can be used to treat severe inflammatory disorders including septic shock (Hwang and Fischer 1999). The presence of bioactive compounds in some endophytic fungi associated with *S. uvedalia* was documented by Rosa et al. (2012), who noted that the various chemicals produced by *Smallanthus* plants can help to protect them against both pathogens and herbivores.

### **Pollinator Dynamics**

The flowers of *Smallanthus uvedalia* are pollinated by an assortment of insects. Taylor (undated) characterized *S. uvedalia* as an excellent nectar and pollen plant that is visited by many

species of bees and wasps. Oppenheimer and Lill (2021) recorded a number of bees visiting the flowers in Maryland, including *Bombus impatiens*, *Ceratina calcarata*, *Agapostemon virescens*, and *Augochlora pura*. Eight different bees were also reported as pollinators by Cruz-Mogollón and Preciado-Quintana, although that study took place in Columbia which is outside of the currently reported range of *S. uvedalia* (see Distribution and Range section). In the eastern United States, 58 species of bees are known to be pollen specialists on flowers in the aster family and most visit multiple genera (Fowler 2016). Butterflies often rest on the flower heads of Bear's-foot while nectaring on the disc florets, which may also result in the transfer of some pollen.

### **Seed Dispersal**

The flower heads of *Smallanthus* only develop a single seed per ray floret so the plants may generate a limited number of propagules, although Taylor (undated) said that a large individual can produce as many as 100 heads. The seeds of *Smallanthus uvedalia* have no evident modifications to facilitate dispersal. The prevalent transport mechanisms in the Asteraceae are wind or mechanical (Dempewolf et al. 2008). In most plants in the aster family, the persistent calyx of the flower (pappus) remains attached to the fruit and aids in dispersal by wind or by attachment to animals (Zhang et al. 2021). However, a pappus is lacking in *Smallanthus* (Robinson 1981). One related species, *S. maculatus*, was reported as autochorous (self-dispersing) by Cortés-Flores et al. (2013), a strategy that results in very limited dispersal distances (Vittoz and Engler 2007). Even if Bear's-foot seeds are primarily dispersed by gravity, some distance from the base of the parent plant may be attained by the length of the spreading inflorescence branches or tilting of the tall stems.

Wells (1969) achieved nearly 100% success when germinating *S. uvedalia* under controlled conditions by removing at least half of a fruit's thick, woody coat before placing it on moist filter paper. He noted that the seedlings grew rapidly in a greenhouse and the plants began to flower in about 70 days. No investigations or descriptions of *Smallanthus uvedalia* reproduction under natural circumstances were found. A developmental study of the morphologically similar *Polymnia canadensis* revealed variable patterns depending on site conditions such as light or moisture availability. Germination was not seasonal although it mainly took place in the spring or fall, and some plants took up to two years to mature (Bender et al. 2003). The researchers also found that *P. canadensis* formed a persistent seed bank in the soil. At least one population of *Smallanthus uvedalia* in Michigan was thought to have originated from a decades-old seed bank (Penskar and Crispin 2009).

Vegetative reproduction may also take place. Some clonal activity has been reported in *Smallanthus sonchifolius* (Ibañez et al. 2017), and Fern (2016) indicated that *Smallanthus uvedalia* plants can be divided for propagation. It is unclear how frequently the plants propagate vegetatively in nature or what the relative importance of sexual/asexual reproduction to the maintenance of an established population might be.

## **Habitat**

*Smallanthus uvedalia* is able to grow in a wide array of habitat types and conditions. Szakacs (2020) developed a shade tolerance classification for herbaceous flora of the upper Piedmont in Virginia and the Carolinas and placed *S. uvedalia* in the generalist guild, which consisted of species that were not strongly associated with either open or shaded sites. Bear's-foot is a characteristic herb of shortleaf pine-oak-hickory woodlands in Florida—a dry, upland, community that is maintained by fire—but also often occurs in wet sites (Clewell 2013, Strother 2020). The species may be found along the banks of rivers and streams or on ravine slopes, growing at elevations from 10–300+ meters (Rhoads and Block 2007, Cyrus 2016, Strother 2020). Reported substrates have included undisturbed alluvial soils, moist limestone slopes, and sandy dunes (Kral 1966, Overlease 1987, Easley and Judd 1993), and a few *S. uvedalia* plants were even found on old shell middens at the edge of coastal salt marshes (Stalter et al. 2003). Other reported habitats include bottomland forests, rich woods, forest and swamp margins, sunny slopes, thickets, fields, and savannas (Wunderlin 1971, McComb and Noble 1982, Rhoads and Block 2007, Penskar and Crispin 2009, Cyrus 2016, Weakley 2015, PANHP 2019, Strother 2020, Taylor undated).

Unsurprisingly for a species that can tolerate such a broad range of growing conditions, *Smallanthus uvedalia* can also be found in disturbed habitats (Weakley 2015). McAtee (1919) noted that *S. uvedalia* was common in waste places, and Easley and Judd (1993) observed the plants growing in ruderal places around public areas and roadsides on a barrier island. Both of New Jersey's extant populations occur in disturbed sites along roadsides and in old agricultural fields (NJNHP 2022).

## **Wetland Indicator Status**

*Smallanthus uvedalia* is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is considered to be Upland (UPL) in all regions where it occurs. The UPL designation means that it almost never occurs in wetlands (U. S. Army Corps of Engineers 2020). Nevertheless, Strother (2020) indicated that *S. uvedalia* often grows in wet sites and some reported habitats have been characterized as moist (e.g. Overlease 1987, Weakley 2015, PANHP 2019, Taylor undated).

## **USDA Plants Code (USDA, NRCS 2022b)**

SMUV

## **Coefficient of Conservatism (Walz et al. 2018)**

CoC = 8. Criteria for a value of 6 to 8: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

## Distribution and Range

*Smallanthus uvedalia* is native to the continental United States and Mexico, and the species has become established in Bermuda and China (POWO 2022). The map in Figure 1 depicts the extent of *S. uvedalia* in the United States. Turner (1988) suggested the inclusion of *Smallanthus maculatus* within *S. uvedalia*, having found no characteristics that would consistently separate the species. Acceptance of that revision would extend the range of *S. uvedalia* throughout all of Central America (Weakley 2015, Strother 2020). Vitali (2014) maintained *S. maculatus* as a distinct species but nevertheless indicated that Central America is included in the range of *S. uvedalia*.

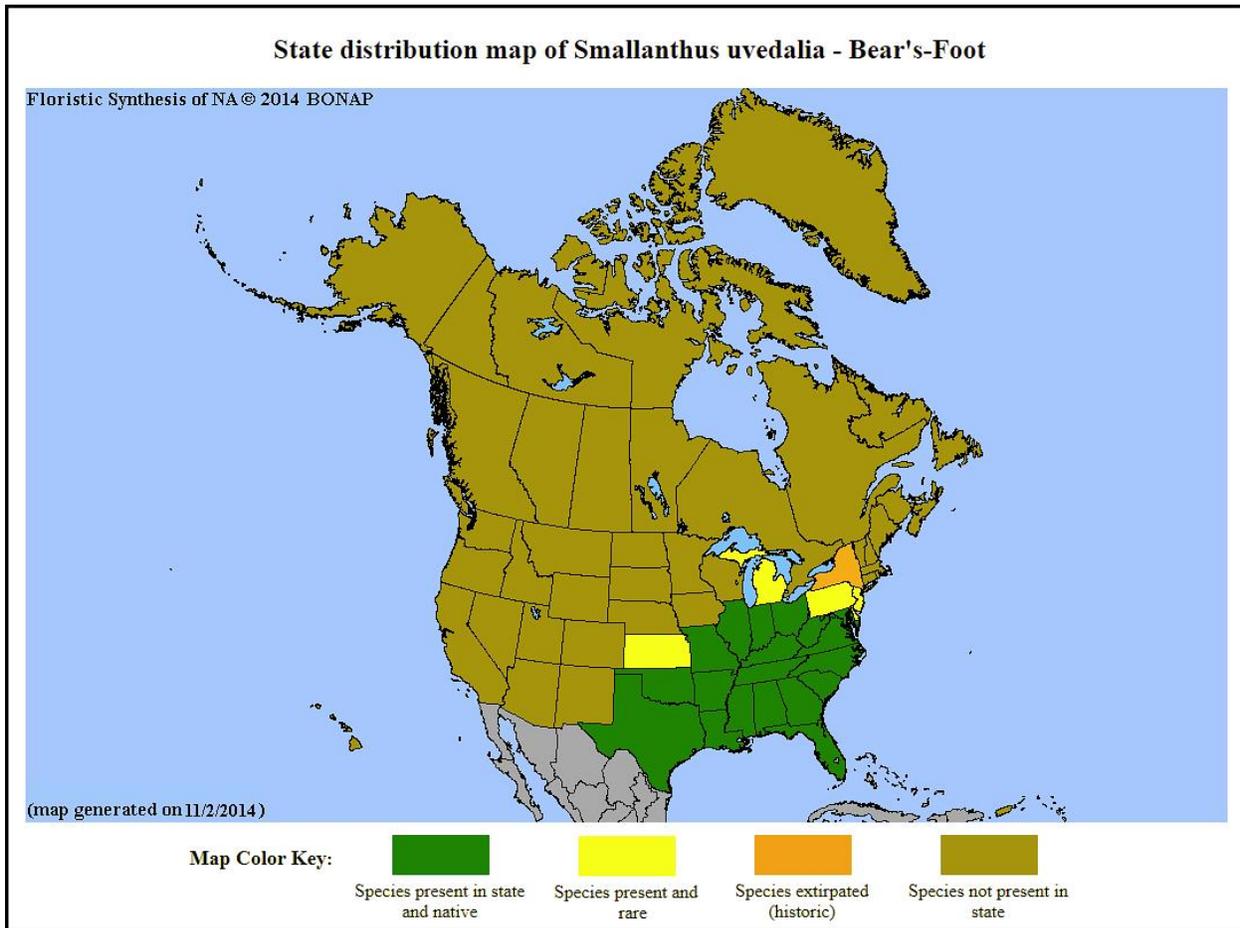


Figure 1. Distribution of *S. uvedalia* in the United States, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2022b) shows records of Bear's-foot in three New Jersey counties: Cape May, Hudson, and Sussex (Figure 2 below). The data include historic observations and do not reflect the current distribution of the species.

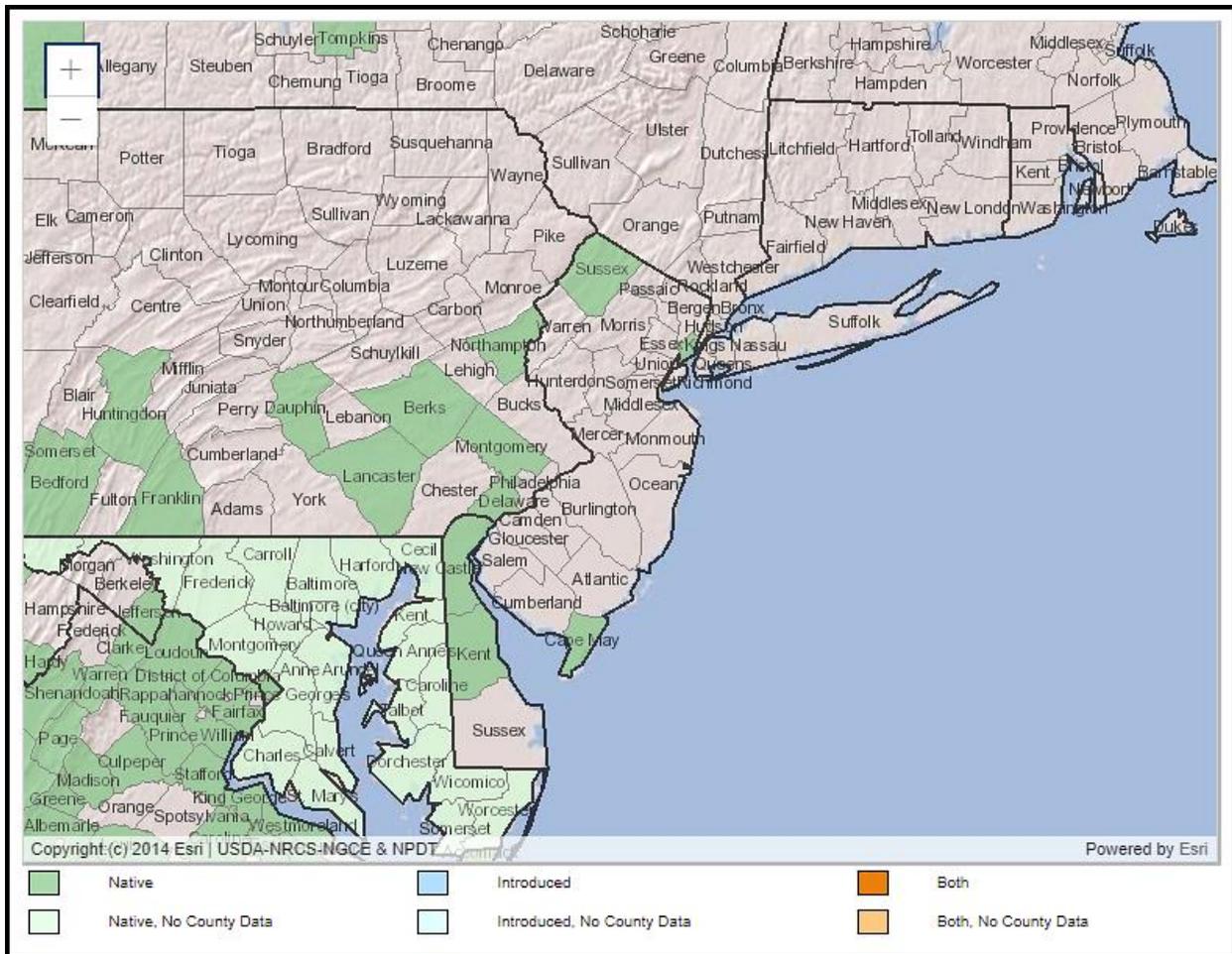


Figure 2. County records of *S. uvedalia* in New Jersey and vicinity (USDA NRCS 2022b).

## Conservation Status

*Smilanthus uvedalia* has a global rank of G4G5, meaning there is some uncertainty as to whether it should be considered apparently secure or secure. A G4 species has a 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 local recent declines, threats, or other factors. A G5 species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2022). The map below (Figure 3) illustrates the conservation status of *S. uvedalia* throughout the United States. Bear's-foot is critically imperiled (very high risk of extinction) in three states, imperiled (high risk of extinction) in one state, vulnerable (moderate risk of extinction) in two states, and possibly extirpated in New York. It is secure, apparently secure, or unranked in other states where it occurs.

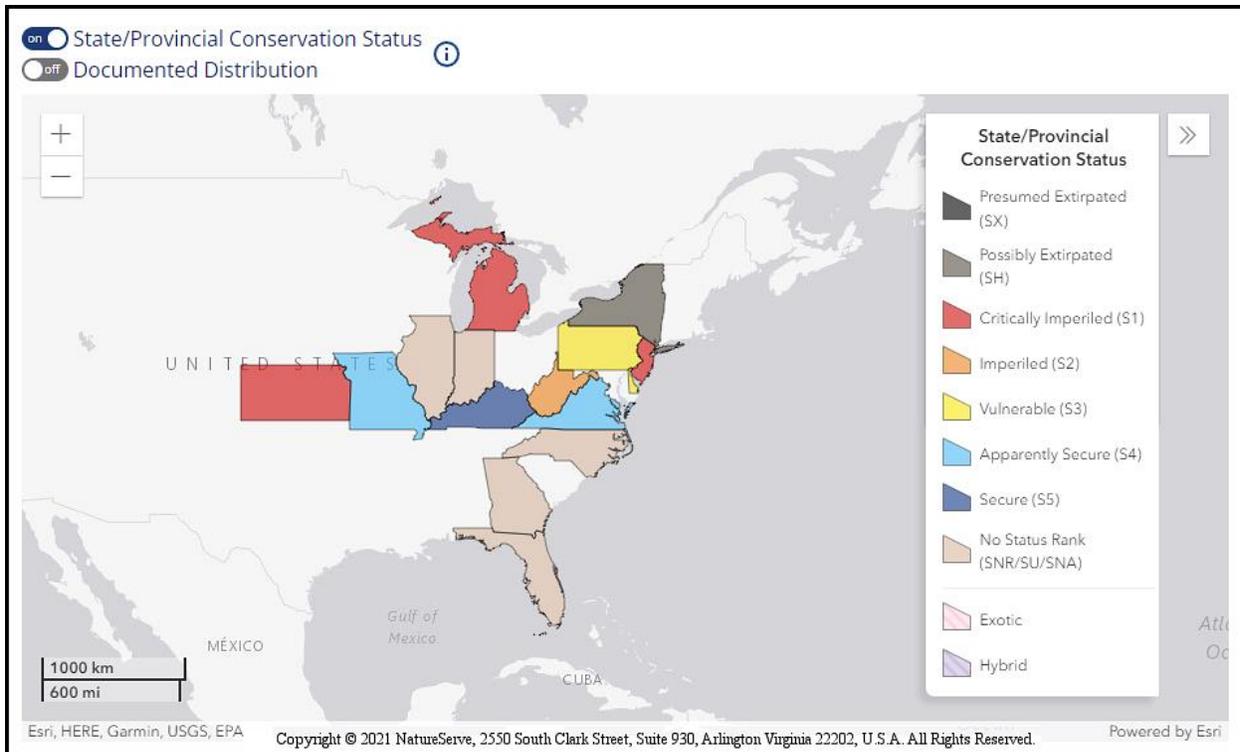


Figure 3. Conservation status of *S. uvedalia* in North America (NatureServe 2022).

New Jersey is one of the states where *Smallanthus uvedalia* is critically imperiled (NJNHP 2022). The S1 rank signifies five or fewer occurrences in the state. A species 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. *S. uvedalia* 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, being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to the plant signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

New Jersey's first known occurrence of *Smallanthus uvedalia* was documented by a specimen in 1864, but by 1870 the site where it had been found was already in danger of destruction (Leggett 1870). Taylor (1915) reported that the species had not since been collected in the state. In the decades that followed a population was found in Sussex County, but Fairbrothers and Hough (1973) categorized Bear's-foot as endangered because it was only present at a single site. In 2000 David Snyder discovered a second population at the other end of the state, and those two records remain the only extant occurrences of the species in New Jersey (NJNHP 2022).

## **Threats**

It is difficult to ascertain why *Smallanthus uvedalia* is so rare in New Jersey, particularly when the plants seem to be able to utilize a broad array of habitats. It may be limited by poor dispersal

or by establishment requirements that impede the species' ability to reach and colonize new sites when old habitats are lost. Bear's-foot also appears to be most vulnerable along the northern edge of its range, and climactic requirements may have limited the plant's spread in that direction.

Significant portions of both of New Jersey's extant *S. uvedalia* populations are situated near streets, and roadside vegetation management (e.g. mowing) has been identified as a concern during monitoring visits (NJNHP 2022). Roadways were identified as one of the most frequent threats to rare plant populations in Sussex County, and road maintenance has been cited as a common cause of extirpation in Cape May County (Breden et al. 2006).

Additional threats to New Jersey's populations have been reported due to impacts from invasive plant species including Multiflora Rose (*Rosa multiflora*), Autumn Olive (*Elaeagnus umbellata*) and Japanese Wisteria (*Wisteria floribunda*). Although the competitive ability of *Smallanthus uvedalia* is largely unknown, all three of those exotic species are formidable rivals because they are able to form dense, nearly monospecific thickets (Kaufman and Kaufman 2007).

Herbivory may or may not be a problem. Some of the compounds produced by *Smallanthus uvedalia* are likely to deter herbivores (Rosa et al. 2012), and Taylor (undated) noted that the entire plant has a resinous odor. However, Hardcastle et al. (2007) found that aromatic compounds did not prevent herbivory in *Polymnia cossatotensis*. Cyrus (2016) included *S. uvedalia* on a list of apparently palatable species browsed by White-tailed Deer (*Odocoileus virginianus*) in Maryland, but the extent of the damage was not reported.

In some parts of *S. uvedalia*'s range insects cause damage to floral receptacles and developing fruits. Larvae of the non-frugiverous Tephritid (fruit fly) *Rhynencina longirostris* were found in the flower heads of *Smallanthus uvedalia* in Tennessee (Steck and Sutton 2000). The fly apparently has a limited range from Pennsylvania to Georgia, and no other species of *Rhynencina* is known to occur in New Jersey (iNaturalist 2022, BugGuide 2022). However, two different species of Tephritid are known to breed on the flowers of *Smallanthus maculatus* (Dzul-Cauich et al. 2014) so there may be a comparable fruit fly in New Jersey that utilizes *S. uvedalia*.

### **Management Summary and Recommendations**

Despite being located in disturbed habitat, New Jersey's two extant *Smallanthus uvedalia* populations are well-established and fairly stable. However, the plants could benefit from some management that is focused on the control of invasive species or the establishment of restrictions on roadside maintenance (e.g. avoiding the use of herbicides or limiting mowing to certain times of year).

Long term conservation of *Smallanthus uvedalia* requires an investment in research. Many studies of *S. uvedalia* have been focused on bioactive compounds, but significant gaps exist in information regarding critical aspects of the species' life history. Potential topics for investigation include mechanisms for local and long-distance seed dispersal, germination and

establishment requirements, the role of sexual and asexual reproduction in population maintenance, the frequency and extent of herbivory, and the impacts of competition. It would also be useful to understand whether temperature or other climatic conditions are limiting factors at the northern boundary of the species range. A more comprehensive knowledge base will permit better planning for protection and management of the species in the face of changing climate conditions and can serve as a foundation for any restoration or reintroduction efforts that may be considered in the future.

## **Synonyms**

The accepted botanical name of the species is *Smallanthus uvedalia* (L.) Mackenzie ex Small. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA NRCS 2022b, POWO 2022). Blake (1917) described three varieties of *S. uvedalia* based on regional discrepancies in the hair on the pedicels and branches of the inflorescence, but Wells (1969) found no clear distinction between the subtaxons and attributed the differences to environmental variation.

### **Botanical Synonyms**

*Smallanthus uvedalius* (L.) Mack. ex Small  
*Osteospermum uvedalia* L.  
*Polymnia macrophylla* Raf.  
*Polymnia uvedalia* (L.) L.  
*Polymnia uvedalia* var. *densipilis* S. F. Blake  
*Polymnia uvedalia* var. *floridana* S. F. Blake  
*Polymnia uvedalia* var. *genuina* S. F. Blake  
*Polymniastrum uvedalia* (L.) Small

### **Common Names**

Bear's-foot or Bearsfoot  
Hairy Leafcup  
Large-flowered Leafcup  
Yellow Leafcup

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