Ranunculus allegheniensis

Allegheny Mountain Buttercup

Ranunculaceae

Ranunculus allegheniensis by Annkatrin Rose, 2021

***Ranunculus allegheniensis* 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

Ranunculus allegheniensis (Allegheny Mountain Buttercup) is a terrestrial herb in the buttercup family that grows from slender roots. The stems are smooth, widely branched, and erect, ranging between 1–7 dm in height but usually under 5 dm. The long-stalked basal leaves are typically kidney-shaped with wavy margins but some may also be lobed. The stem leaves and floral bracts are nearly stalkless and divided almost to the base, forming narrow or linear segments. The flowers are solitary on long pedicels that may be smooth or slightly hairy. Each flower has 5 ovate sepals that are 2–3 mm long with colorless hairs on the undersides and 5 tiny yellow petals that are usually less than half the size of the sepals. Up to 50 ovaries are clustered on a central receptacle and surrounded by 10–25 stamens. In fruit the densely packed achenes form a head that is ovoid or cylindrical. When the achenes mature the styles persist as long (0.6–1.0 mm), strongly curved beaks. (See Britton 1895, Britton and Brown 1913, Fernald 1950, Mitchell and Dean 1982, Gleason and Cronquist 1991, Whittemore 2020).

Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Annkatrin Rose, 2021.

Ranunculus is a large genus that has been subdivided into multiple units and *R. allegheniensis* has been placed in subgenus *Ranunculus* section *Epirotes* (Whittemore 2020). In New Jersey there are two closely related species that could be confused with *Ranunculus allegheniensis*: *R. abortivus* and *R. micranthus*. *Ranunculus micranthus* is rare in the state (S2) and can be distinguished from the other two species by its somewhat hairy stems and swollen root-bases. *Ranunculus abortivus* is widespread in New Jersey and visually similar to *R. allegheniensis*—Sanford (1924) noted that after the latter species was described "botanists naturally hastened to examine their collections and to observe more carefully in the field the plants which had been passing as *R. abortivus*." *Ranunculus abortivus* is also morphologically plastic, which has resulted in the description of several varieties in the past (Whittemore 2020). Fruits are needed for positive identification as the long, curved beaks on the achenes of *R. allegheniensis* are the most reliable way to separate the species from its close relatives (Greene 1914, Bell 1945). *R. abortivus* also lacks hair on the underside of the sepals. Caution is still needed when making a determination because hybridization is possible. Although there are some chemical and chromosomal differences between these three species, cross-fertilization experiments have

demonstrated that they can hybridize (Sobel 1974, 1977). Blackwell (1977) reported on a naturally-occurring *R. abortivus* × *R. micranthus* hybrid, noting that it was similar to *R. allegheniensis* in appearance.

There is a paucity of information available regarding the life history of Allegheny Mountain Buttercup. It is often cited as a perennial species (eg. Benson 1940, USDA NRCS 2023b) but sometimes classified as an annual plant (eg. Wender 2000). Mitchell and Dean (1982) suggested that *Ranunculus allegheniensis* could be either an annual or a short-lived perennial. In New Jersey the species behaves somewhat like an annual with colonies that can reappear after several years' absence or fluctuate in size from one growing season to the next (NJNHP 2022). Throughout its range *R. allegheniensis* flowers between April and June, and fruits may be present into July (Britton 1895, Mitchell and Dean 1982, Weakley et al. 2022, Whittemore 2020).

Pollinator Dynamics

Ranunculus allegheniensis is likely to be pollinated by insects, as nectaries are present at the bases of the tiny petals (Benson 1940). Studies of the closely related *R. abortivus* found that its flowers were unscented (Meehan 1892) but attracted an assortment of visitors that included long and short tongued bees, flies, and ladybugs (Robertson 1894, Robertson 1929).

Both Meehan (1892) and Robertson (1894) observed that the structure of *R. abortivus* flowers was designed to limit self-fertilization, although Robertson also noted that pistils on the lower part of the receptacles were more likely to receive pollen from adjacent anthers than those near the top. When hand-pollinated in a laboratory setting, both *R. abortivus* and *R. allegheniensis* were found to be self-fertile (Sobel 1977).

Seed Dispersal

Each *Ranunculus allegheniensis* flower can produce up to 50 one-seeded achenes (Mitchell and Dean 1982). An average production of 266 seeds per plant was reported for *R. abortivus* (Mabry 2004). The hooked tips on *R. allegheniensis* fruits suggest animal dispersal via adherence to fur or feathers (Howe and Smallwood 1982). Some of the fruits may also be distributed following consumption by birds or animals: For example, Farmer et al. (2017) reported the successful germination of a *Ranunculus abortivus* seed recovered from the digestive system of a duck. When Beattie and Culver (1981) tested an assortment of forest herbs for myrmecochory, ants showed no interest in *R. allegheniensis* seeds.

No species-specific information about the germination and establishment requirements of *Ranunculus allegheniensis* was found. Seed banking has been documented in *R. abortivus* (Gunterspergen and Kunowski 1985, Beatty 1991). According to Deno (1993), germination requirements vary considerably within the genus. Mycorrhizae have been found in more than a dozen *Ranunculus* species, including two in section *Epirotes* (Wang and Qiu 2006).

Habitat

Although often associated with mountains, *Ranunculus allegheniensis* seldom occurs at elevations above 1000 meters (Emadzade et al. 2015). The plants typically grow in forested habitats. The canopy is usually composed of hardwood species (Anacker and Kirschbaum 2006, Frye 2021) but the buttercup can also grow beneath pines (Benson 1941). Dominant trees in the vicinity of the New Jersey population include *Liriodendron tulipifera*, *Acer saccharum*, and *Quercus* spp. (NJNHP 2022). *Ranunculus allegheniensis* and the similar *R. abortivus* co-occur at the site (Snyder 1989).

R. allegheniensis has been found on ridges, rocky slopes, and valley floors (Fairbrothers and Hough 1973, Snyder 1989, Searcy 2008, Frye 2021, Weakley 2022). Knowlton et al. (1918) characterized Allegheny Mountain Buttercup as a calciphile but Weatherby (1935) described it as only mildly calciphilous. Although it has frequently been reported to favor calcareous substrates (Bell 1945, Keener 1976, Rhoads and Block 2007, Angelo and Boufford 2010, Weakley et al 2022), *R. allegheniensis* has also been documented in strongly acidic soils (Anacker and Kirschbaum 2006) and it was identified as a characteristic species of Acidic Cove Forest (Poindexter 2013). Some Kentucky populations were growing over largely non-calcareous bedrock (Campbell and Medley 1990) and Knowlton (1919) reported it on metamorphic substrate although he suggested that some lime may have been introduced by glacial drift.

The soils in *R. allegheniensis* habitats are usually described as moist, mesic, or damp (Benson 1941, Searcy 2008, Angelo and Boufford 2010, Frye 2021) but the plant can also grow in dry sites (Knowlton et al. 1918, Mitchell and Dean 1982, Weakley et al. 2022). One New Jersey subpopulation was found in a site where the soil varies seasonally from moist to dry while another was situated in soils that remain moist throughout the year (NJNHP 2022).

Ranunculus allegheniensis is not limited to pristine habitats. A 2011 study in Massachusetts found that *R. allegheniensis* was still present in an isolated patch of forest surrounded by highly developed suburban landscape where it had been known to occur since 1895 (Hamlin et al. 2012). The species has also occasionally been found growing in other somewhat disturbed sites including fence-rows, roadsides, and pastures (Bissell 1903, Bell 1945, Silberhorn 1966, Whittemore 2020, NJNHP 2022).

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). *Ranunculus allegheniensis* has more than one wetland indicator status within the state. In the Atlantic and Gulf Coastal Plain region, *R. allegheniensis* is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands. In other parts of the state it is a facultative species, meaning that it occurs in both wetlands and nonwetlands (U. S. Army Corps of Engineers 2020).

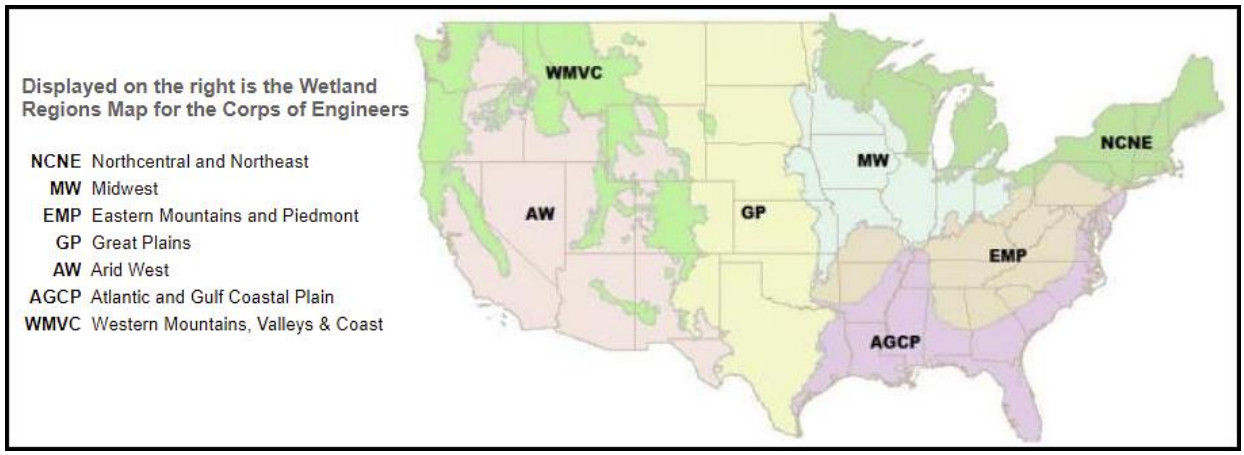

Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2023b)

RAAL2

Coefficient of Conservatism (Walz et al. 2018)

CoC = 7. 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

The global range of *Ranunculus allegheniensis* is restricted to the eastern United States (POWO 2023). The map in Figure 2 depicts the worldwide extent of the species. In addition to the states included on the map, *R. allegheniensis* has been reported in New Hampshire (Knowlton et al. 1918, Bean et al. 1960).

The USDA PLANTS Database (2023b) shows records of *Ranunculus allegheniensis* in two New Jersey counties: Passaic and Sussex (Figure 3). The data include historic observations and do not reflect the current distribution of the species.

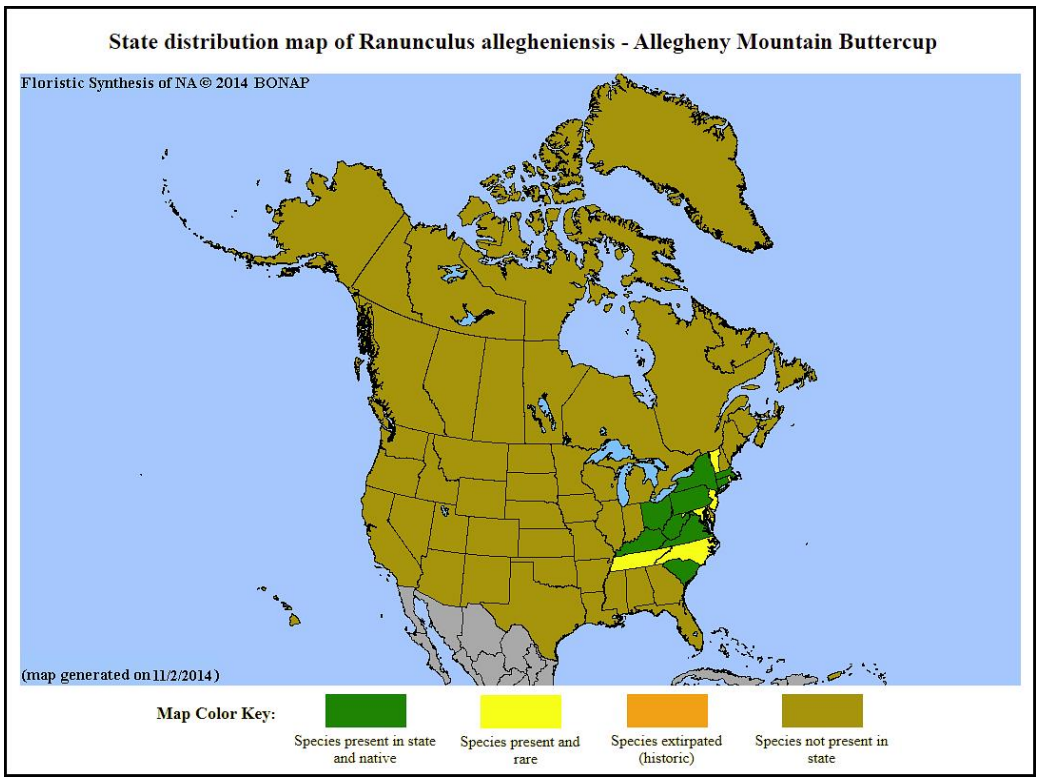

Figure 2. Distribution of R. allegheniensis in North America, adapted from BONAP (Kartesz 2015).

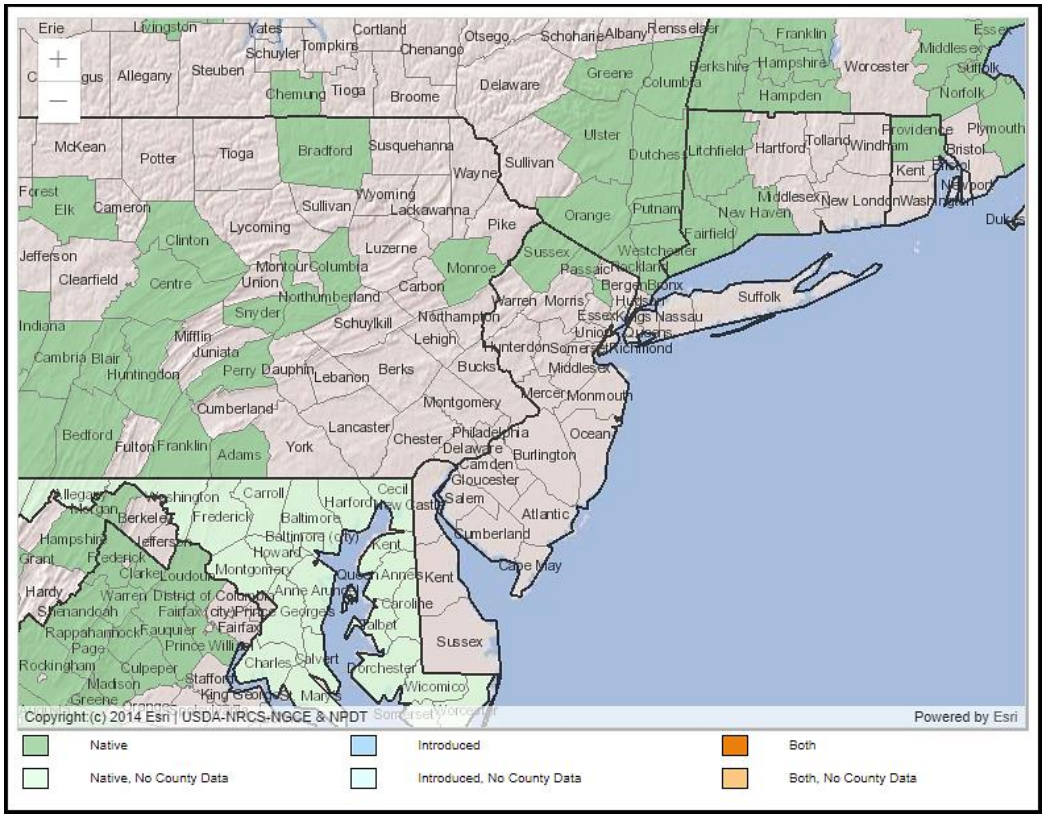

Figure 3. County records of R. allegheniensis in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Ranunculus allegheniensis 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 2023). The map below (Figure 4) illustrates the conservation status of *R. allegheniensis* throughout its range. Allegheny Mountain Buttercup is critically imperiled (very high risk of extinction) in two states, imperiled (high risk of extinction) in three states, and vulnerable (moderate risk of extinction) in two states. The species is apparently secure or unranked in other states where it has been documented.

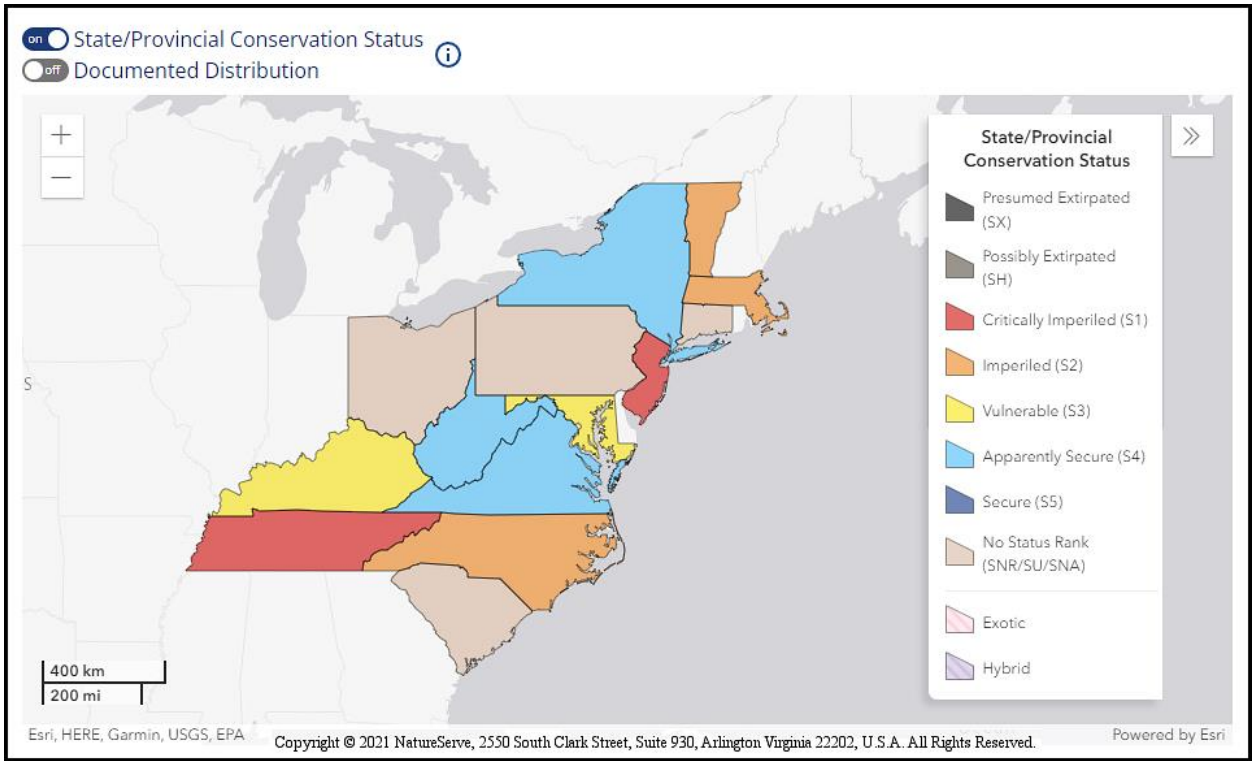

Figure 4. Conservation status of R. allegheniensis in North America (NatureServe 2023).

Ranunculus allegheniensis is ranked S1.1 in New Jersey (NJNHP 2022), meaning that it is critically imperiled due to extreme rarity. A species with an S1.1 rank has only ever been documented at a single location in the state. *R. allegheniensis* 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 *R. allegheniensis* 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).

Allegheny Mountain Buttercup was first collected in Sussex County during 1920 but after 1930 it was not seen again in New Jersey for more than half a century (Hough 1983). In 1988, Tom Halliwell discovered *R. allegheniensis* within a mile of the location where it had originally been collected (Snyder 1989). Subsequent visits to the site documented three small subpopulations (NJNHP 2022). A map in the New York Metropolitan Flora database (Glenn 2013) shows a post-1990 record of *Ranunculus allegheniensis* in Passaic County but that occurrence remains unconfirmed (NJNHP 2022).

Threats

New Jersey's sole documented population of *Ranunculus allegheniensis* appears to be threatened by invasive plants, particularly *Alliaria petiolata*. *A. petiolata* (Garlic Mustard) can rapidly become dominant in forest understories, crowding out native flora, and the species may also inhibit the growth of mycorrhizal fungi (Kaufman and Kaufman 2007). The spread of *A. petiolata* at the site of New Jersey's *Ranunculus allegheniensis* population was first noted in 2007 along with a decline in the rare plants that seems to have continued (NJNHP 2022).

Many of New Jersey's forest herbs are threatened by deer browse but that is probably not a concern for *Ranunculus allegheniensis*. Most species of *Ranunculus* are poisonous due to the presence of an oily glycoside (ranunculin) in living plants and concentrations are likely to be highest while the plants are in bloom. When chewed, ranunculin is converted to an irritant (protoanemonin) that can cause swelling and blistering of the mouth, skin, and digestive system and the unpleasant reaction may deter extensive herbivory. Although the toxin has not been specifically reported in *R. allegheniensis* it has been documented in the closely related *R. abortivus* (Martinson et al. 2007, CSUVTH 2022).

Ranunculus allegheniensis and its close relatives are susceptible to a rust fungus, *Puccinia eatoniae* var. *ranunculi* (Mitchell and Dean 1982). Many rust fungi require multiple hosts in order to complete their life cycle and the alternate hosts for *P. eatonii* var. *ranunculi* are grasses in the genus *Sphenopholis* (Jackson 1917). The rust forms spores on the underside of the *Ranunculus* leaves in the spring, covering the lower surfaces of most leaves (Mains 1932). *Puccinia* infections can reduce growth, decrease flowering, hasten mortality, or increase a host plant's vulnerability to other stresses (Paul and Ayres 1986 and1987, RHS 2023).

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). There is insufficient information regarding the life history traits and ecological requirements of *Ranunculus allegheniensis* to predict the likely impacts of climate change on local populations. Some studies comparing historical and recent blooming dates of assorted plants reported that *R. abortivus* has not advanced its flowering dates in recent years (Abu-Asab et al. 2001, Dunnell and Travers 2011). A comparable lack of phenological adaptability in *R. allegheniensis* might result in a loss of synchronization with key pollinators or less favorable conditions for seedling establishment.

Management Summary and Recommendations

Significant gaps in knowledge regarding *Ranunculus allegheniensis* make it difficult to do meaningful management planning for the species. Since the extent of *R. allegheniensis* in New Jersey is restricted to one small occurrence, efforts should be made to preserve the remaining plants at that site. Even on a limited scale, the selective removal of invasive flora could give the rare buttercup an opportunity to persist. Careful searches of the area might also turn up some additional colonies: *R. allegheniensis* is easily overlooked due to its similarity to the more common *R. abortivus*, particularly since the two species co-occur in the state.

An investment in research is recommended in order to establish some baseline information about *Ranunculus allegheniensis*. Clarity is needed regarding the species' life cycle, as current concepts appear to be based on short-term observations rather than multi-season studies. Documentation of the buttercup's pollinators is crucial, particularly since the closely related *R. abortivus* does not appear to be shifting its flowering period as the climate warms. While experimental work has demonstrated that *R. allegheniensis* is self-compatible, it is important to understand whether self-fertilization is mechanical or insect-mediated under natural circumstances. Additional topics suggested for studies of *R. allegheniensis* include seed dispersal and longevity, germination and establishment requirements, mycorrhizal relationships, and responses to competition from native and non-indigenous plants.

Synonyms

The accepted botanical name of the species is *Ranunculus allegheniensis* Britton. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2023, USDA NRCS 2023b).

Botanical Synonyms	**Common Names**
	Allegheny Mountain Buttercup
	Allegheny Crowfoot
	Mountain Crowfoot

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