Filipendula rubra

Queen-of-the-prairie

Rosaceae

Filipendula rubra by John Hilty

***Filipendula rubra* Rare Plant Profile**

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

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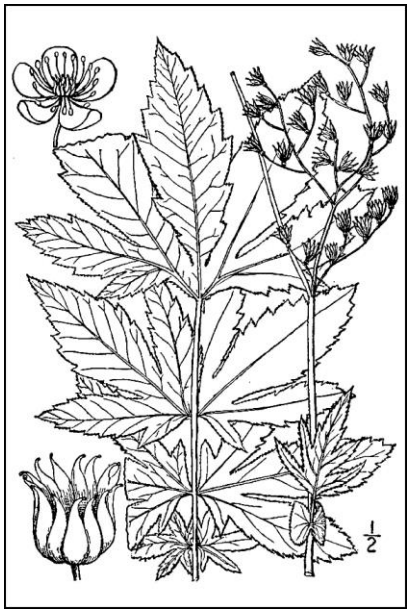
Life History

Filipendula rubra (Queen-of-the-prairie) is a showy perennial herb in the Rosaceae. Robinson (1906) remarked that "*few of the native plants of the Middle West exceed in beauty the 'Queen of the Prairie' with its pinnate leaves, palmately lobed leaflets, and numerous gracefully panicled flowers*." *Filipendula rubra* reproduces vegetatively via long subterranean runners that may increase in length by 10–20 cm per year (Schanzer 1994). Over time, disintegration of the rhizomes can create a clustered distribution of plants that developed clonally. A typical clump is likely to include both flowering and nonflowering plants (Aspinwall and Christian 1992a, Murphy et al. 2021). *F. rubra* is slow-growing and long-lived: Aspinwall and Christian (1992a) conjectured that one Missouri clone they studied was hundreds, or even thousands, of years old.



Left: Britton and Brown 1913, courtesy USDA NRCS 2024a. Right: John Hilty, undated.

The stems of *Filipendula rubra* are hollow, ribbed, and 1.2–2.5 meters in height. A detailed description of stem structure was provided by Lotova and Timonin (1999). Ovate stipules 1–1.5 cm long are present at the base of the leaf petioles. The alternate stem leaves are pinnately divided, with a large (10–15 cm) terminal leaflet and 1–5 pairs of smaller lateral leaflets. The leaflets are palmately lobed and toothed. Similar basal leaves are produced but disappear by flowering time. The inflorescence is many-branched, with lateral branches that exceed the central stalk in length, and it contains numerous flowers. The flowers of *F. rubra* usually have 5 bright pink petals (although the number can vary from 4–6), 20–30 short stamens, and 5–15 pistils. The fruits are flat, straight, smooth, single-seeded achenes 8–14 mm long. (See Britton and Brown 1913, Fernald 1950, Robertson 1974, Gleason and Cronquist 1991, Schanzer 1994 & 2020). Other *Filipendula* species that occur in the eastern United States are introduced and can be distinguished by their white or cream-colored flowers (Schanzer 2020).

Throughout its range *Filipendula rubra* may flower from June to August (Robison and White 1987, Mower and Lee 2003, Rhoads and Block 2007). Late June to early August was noted for New Jersey (Hough 1983). Blooming dates reported for Missouri were late June to mid-July,

with peak flowering occurring between June 24 and July 5 (Orzell 1983). A repeated survey in Ohio found that the species previously (1992–1996) bloomed in July but more recently (2005–2008) bloomed during June (Conover and Pelikan 2010). The fruits develop from July through September (Weakley et al. 2024), so some fruits may already be present while other plants in the population are still in flower (Murphy et al. 2021).


Left: Courtesy R. W. Smith, Lady Bird Johnson Wildflower Center. Right: Paul Marcum, 2021.

The genus *Filipendula* does not appear to align closely with other members of the rose family, and many of its species have variable chromosome numbers (Dickinson et al. 2007, Potter et al. 2007). Aspinwall and Christian (1992a) detected very low genetic variability in *F. rubra*. Queen-of-the-prairie has traditionally been used as a remedy for a wide assortment of medical purposes (Schanzer 2020), and recent research found that extracts from *F. rubra* leaves had a significant inhibitory effect on *Staphylococcus aureus*, a common bacterial pathogen (Borchardt et al. 2008).

Pollinator Dynamics

Britton and Brown (1913) noted that the flowers of *Filipendula rubra* were fragrant. Many other *Filipendula* species have sweetly-scented blooms, although the odor of *F. ulmaria* flowers has been described as "sickly" (Genders 1977). Henrickson (2008) likened the smell of *F. rubra* to cotton candy. The inflorescence of Queen-of-the-prairie, with its large cluster of brightly-colored flowers, is probably visually attractive to insects. Schuler (2005) found that *F. rubra* plants attracted more pollinators when they occurred in larger clumps or populations, and Battle et al. (2021) reported that pollinators were more abundant on the species when it co-occurred with an assortment of flowering plants. *Filipendula rubra* flowers do not produce any nectar but some visitors can obtain a pollen reward (Battle 2018).

Filipendula rubra is self-incompatible so it is dependent on insects for cross-fertilization (Aspinwall and Christian 1992a, 1992b). The flowers are pollinated by an assortment of bees (including *Apis, Augochlorella, Bombus, Ceratina, Halictus, Hylaeus,* and *Lasioglossum* species) and flies (including *Anthrax, Holocephala, Mesograpta,* and *Rivellia* species). Pollination is occasionally carried out by other floral visitors such as beetles, true bugs, or ants (Aspinwall and Christian 1992a, Schuler 2005). *Filipendula rubra* has a very high potential for sexual reproduction because a large inflorescence can produce thousands of seeds. Seed counts for 80 plants in Ohio ranged from 203–4,613, averaging 1,377 seeds per plant (Schuler 2005). Aspinwall and Christian (1992a) obtained higher seed counts per inflorescence in a Missouri study (average 2,949). However, they reported very low rates of seed viability: The highest rate recorded was 36%, and in more than half of the inflorescences they sampled less than 1% of the seeds were viable. Limited production of viable seeds in *F. rubra* has also been documented in other studies (e.g. Langley 1995, Battle et al. 2021).

Because *Filipendula rubra* is clonal many or all of the plants at a single location may be genetically identical, so the absence of self-compatibility renders them unable to produce fertile offspring (Aspinwall and Christian 1992a). Pollinators more frequently visit *F. rubra* when multiple plants are flowering in close proximity, and that behavior increases the probability that pollen will be transferred to a related flower in the same clump even when more than one genetic individual is present within a population (Charpentier 2002).

Seed Dispersal and Establishment

The seeds of *Filipendula rubra* have no evident adaptations to facilitate their distribution (Howe and Smallwood 1982) and—despite the fact that many populations in natural settings were assumed to have escaped from cultivation—the dispersal mechanisms of the species have not been studied. *Filipendula ulmaria* and *F. vulgaris* also lack specialized dispersal mechanisms (Lindborg 2007) but their seeds can be disseminated in a variety of ways including wind, water, and animals. Wind dispersal distances up to several kilometers have been reported for *F. ulmaria* (Soons 2006) and the seeds can also be transported by water, particularly following heavy rains (Vogt et al. 2004, Kostrakiewicz-Gierałt 2017). The consumption of *F. ulmaria* seeds by waterfowl can also result in the distribution of viable propagules (Soons et al. 2008). Kiviniemi and Erikkson (1999) found that the densely pubescent seeds of *Filipendula vulgaris* could be carried to new locations by adhering to animal fur, but their research also demonstrated that seeds without hair or other structures to aid in adhesion could be transported in that manner too. Both *F. ulmaria* and *F. vulgaris* can persist in the seed bank for several years (Thompson and Grime 1979, Lindborg 2007).

Because it is strongly clonal, *Filipendula rubra* can easily be propagated by division and may thrive following transplantation into a suitable habitat (Conover and Geiger 1989, Leopold 2005). Even a small piece of its rhizome may be sufficient to establish a new plant (Hamblin 1922). As previously noted, attempts to study seed germination and establishment in *F. rubra* have frequently been thwarted by poor viability, although in one case achenes collected from natural populations and stratified in moist soil for 8–10 weeks produced seedlings (Amon et al. 2005). *Filipendula ulmaria* seeds that were maintained in dry storage germinated in light when

stimulated by diurnal temperature fluctuations of at least 2° C (Thompson and Grime 1983), and that species can reach reproductive maturity as soon as 21 months after germinating (Baker and Baker 1967). *F. ulmaria*, which occupies habitats similar to those favored by *F. rubra*, appears to be facultatively mycorrhizal (Wang and Qiu 2006).

Habitat

Filipendula rubra prefers habitats that are open and wet. It usually occurs at elevations of 0–1,000 meters above sea level (Schanzer 2020), although it has sometimes been found on outcrops at elevations of 1,262–1,725 meters (Wiser et al. 1996). *F. rubra* is often associated with calcareous or mafic substrates. Throughout its range, typical habitats include fens, wet meadows, seeps, and prairies (Steyermark 1952, Thompson 1975, Ramey 1981, Hough 1983, Orzell 1984, Nolin and Runkle 1985, Orzell and Kurz 1986, Aspinwall and Christian 1992a, Robison et al. 1995, Wiser et al. 1996, Hunsucker and Mueller 1998, Heus 2003, Belden et al. 2004, Rhoads and Block 2007, Ruch et al. 2008, Johnson and Walz 2013, Weakley et al. 2024). Habitats recorded in New Jersey include a brushy calcareous fen along the edge of a wooded swamp and an open, marshy meadow (NJNHP 2024). *F. rubra* has also been documented in a number of disturbed habitats including roadsides, ditches, pastures, and hayfields (Fernald 1922, Steyermark and Swink 1955, Orzell 1983, Robison and White 1987, Ruch et al. 2009). Schanzer (2020) noted that the species often persists in abandoned gardens.

Weakley et al. (2024) assigned *Filipendula rubra* a heliophily rank of 8, indicating that the species may occasionally be found in shady sites but does best in open conditions. Except for the high-elevation outcrop habitat that was described as "shady and constantly wet" (Wiser et al. 1996) most of the communities where *F. rubra* occurs provide a high exposure to sunlight. Both Mower and Lee (2003) and Leopold (2005) noted that it could be planted in sun or partial shade. The soil pH is generally circumneutral: In some locations it may be as low as 5.7 and in others as high as 8.0 (Homoya et al. 1985, Belden et al. 2004, O'Connor and Penskar 2007). At a site studied by Choesin and Boerner (2000) there were no significant seasonal variations in ground water chemistry. Experiments comparing the growth of *F. rubra* on gravel and hydric soil substrates showed that the species grew and survived better on the soils (Langley 1995, Amon et al. 2005).

The communities favored by *Filipendula rubra* are usually dominated by grasses, sedges, and rushes. A wide array of broad leaved herbs may also be present. Woody plants are generally absent or sparse, but some that have been noted include *Cephalanthus occidentalis*, *Fraxinus nigra*, *Potentilla fruticosa*, *Salix sericea*, and *Viburnum lentago* (Jones 1944, Orzell 1983 & 1984, Homoya et al. 1985, Robison et al. 1995, Wiser et al. 1996, Choesin and Boerner 2000, Heus 2003, Belden et al. 2004, O'Connor and Penskar 2007, Murphy et al. 2021). However, *F. rubra* has been noted as a common herbaceous species in *Cornus sericea—Photinia melanocarpa—Toxicodendron vernix* saturated shrublands (Breden et al. 2001).

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). *Filipendula rubra* has more than one wetland indicator status within the state. In the Atlantic and Gulf Coastal Plain region it is an obligate wetland species, meaning that it almost always occurs in wetlands. In the rest of the state it is a facultative wetland species, meaning that it usually occurs in wetlands but may occur in nonwetlands (U. S. Army Corps of Engineers 2020).

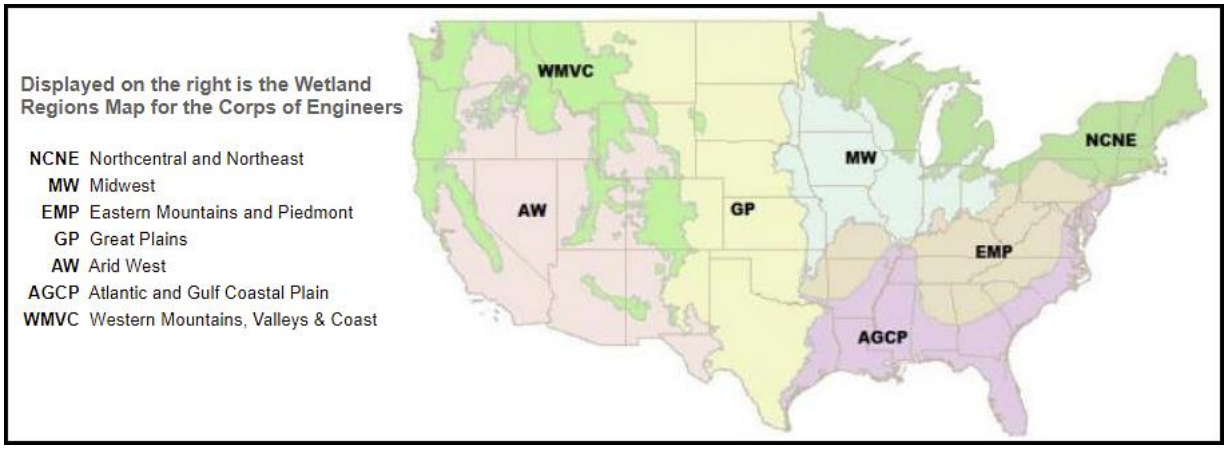


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2024b)

FIRU2

Coefficient of Conservancy (Walz et al. 2020)

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

Filipendula rubra is indigenous to the east central United States but it has spread northward on the continent as a fugitive from cultivation, and it is also introduced in Germany (Schanzer 2020, POWO 2024). The map in Figure 2 depicts the extent of the species in North America. The extensive use of *F. rubra* in horticulture has made it difficult to tell whether some populations, particularly near the range edges, are natural or introduced (e.g. Moody 1908). Sources agree that Queen-of-the prairie is native to the midwestern U. S. but differ in defining the boundaries of its natural distribution (Robinson 1906, Robertson 1974, Heus 2003, Schanzer 2020, Weakley et al. 2024). The occasional populations in the eastern states may be adventive occurrences, indicators of an expanding range, or both.

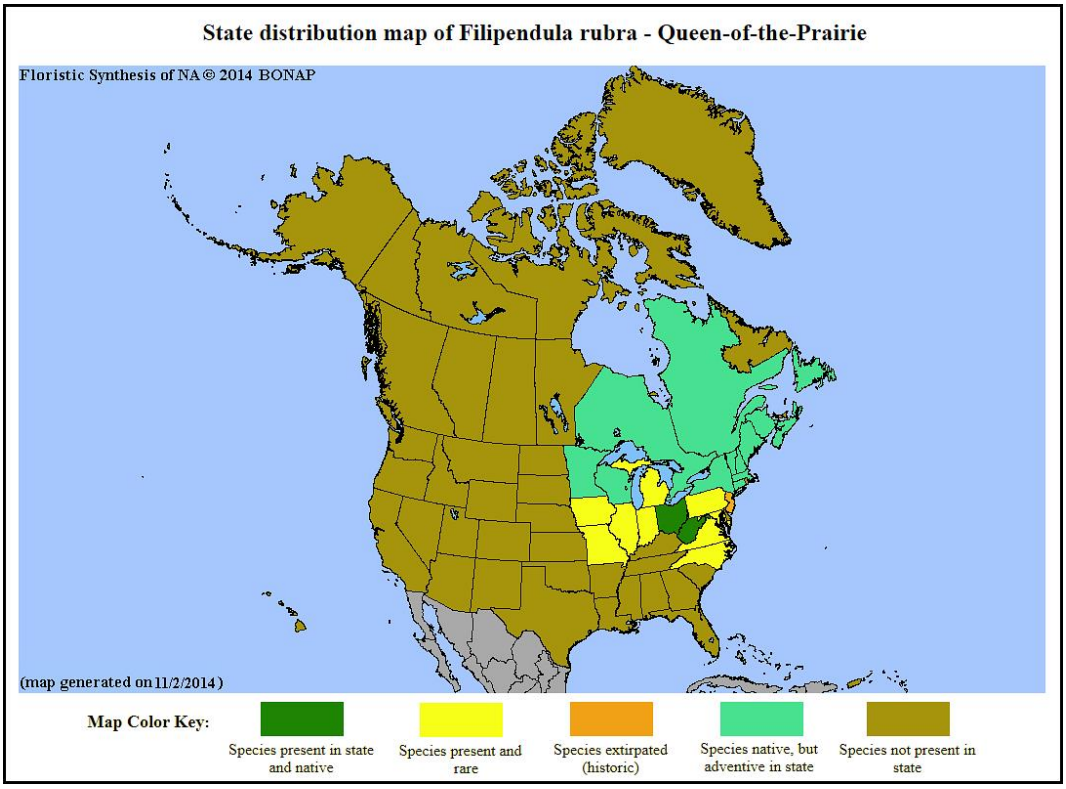


Figure 2. Distribution of F. rubra in North America, adapted from BONAP (Kartesz 2015).

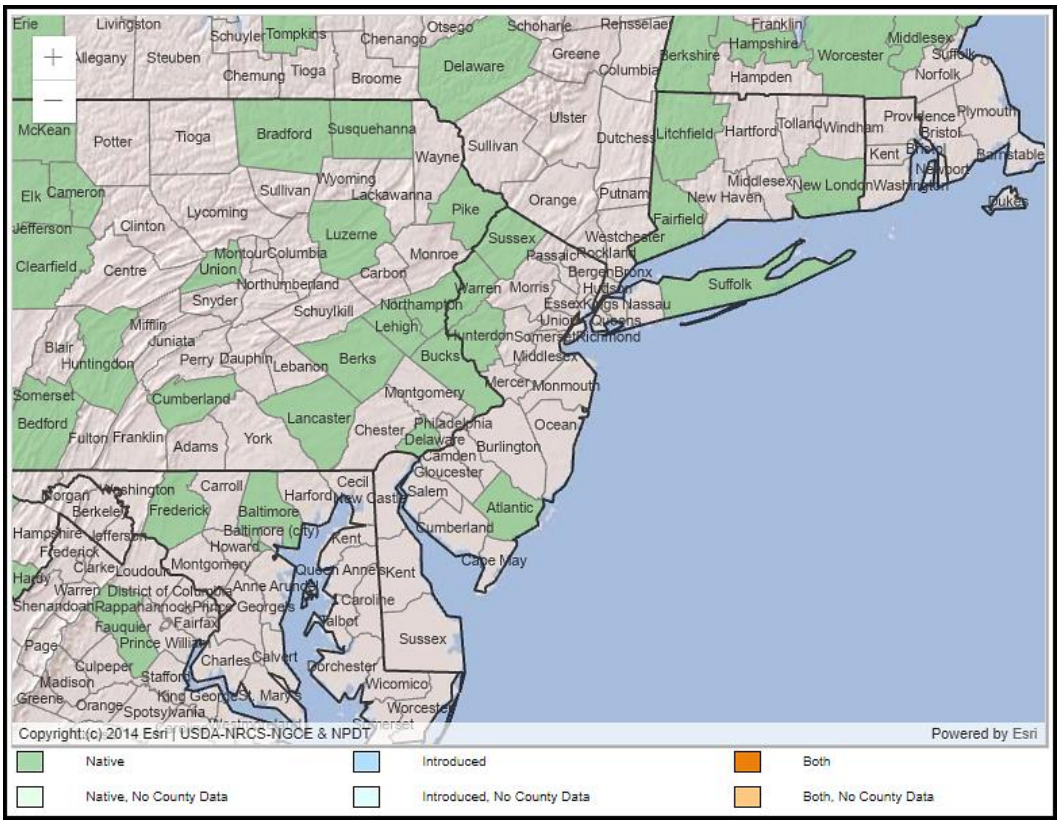


Figure 3. County records of F. rubra in New Jersey and vicinity (USDA NRCS 2024b).

The USDA PLANTS Database (2024b) shows records of *Filipendula rubra* in four New Jersey counties: Atlantic, Hunterdon, Sussex, and Warren (Figure 3 above). The data include historic observations and do not reflect the current distribution of the species.

Conservation Status

Filipendula rubra 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 recent local 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 2024). The map below (Figure 4) illustrates the conservation status of *F. rubra* in North America. Queen-of-the prairie is critically imperiled (very high risk of extinction) in seven states, imperiled (high risk of extinction) in three states, and vulnerable (moderate risk of extinction) in one state. Although the species has not been ranked as secure or apparently secure anywhere in its range it has been documented in many places where it is not considered native, including West Virginia, New England, and southeastern Canada (Go Botany 2024, NatureServe 2024). It is unranked in Ohio, Wisconsin, or Wyoming.

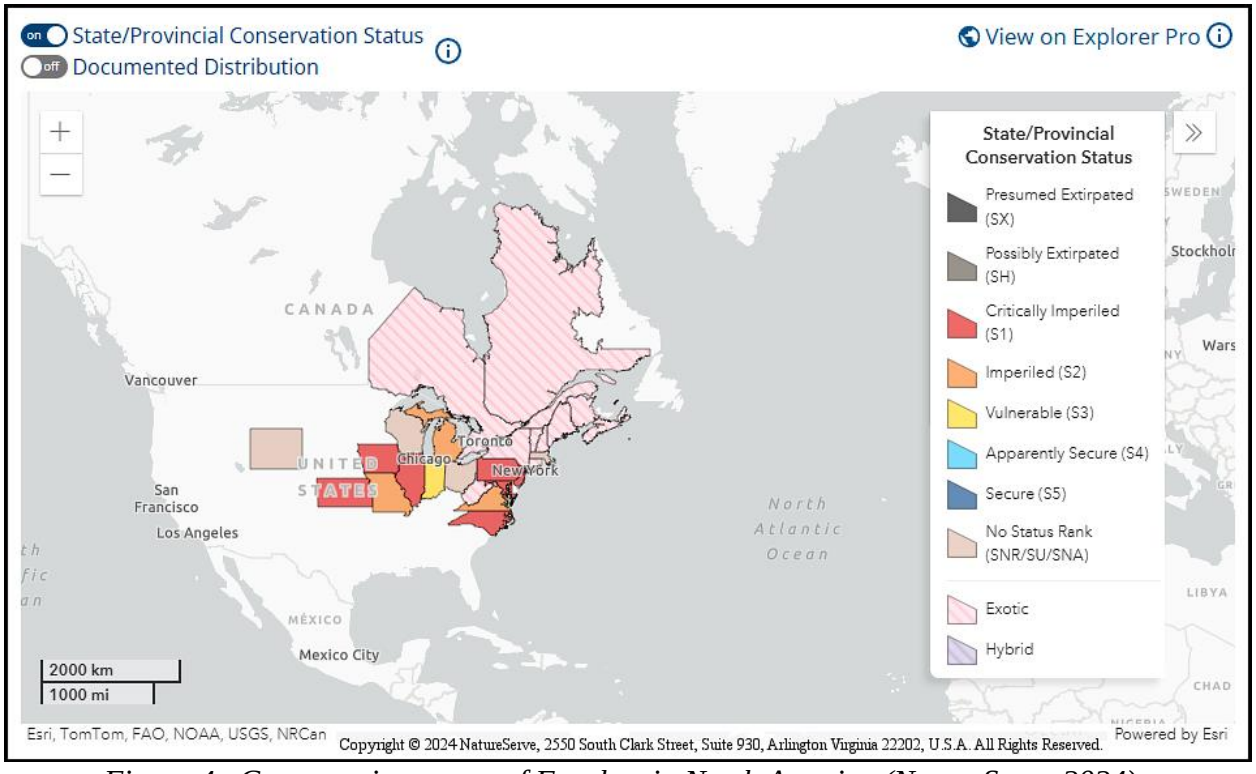


Figure 4. Conservation status of F. rubra in North America (NatureServe 2024).

Filipendula rubra is critically imperiled (S1) in New Jersey (NJNHP 2024). The 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. *F. rubra* has also been assigned a regional status code of HL, signifying that the species is eligible for protection under the jurisdiction of the Highlands Preservation Area (NJNHP 2010).

The first occurrence of *Filipendula rubra* that was documented in New Jersey was thought to be an escape from cultivation (Britton 1889, Taylor 1915). The species was subsequently collected from additional locations, and Hough (1983) indicated that not all of the populations in the state had been introduced. She showed *F. rubra* in four counties, noting that the record from Atlantic County was unverified but records from Hunterdon, Sussex, and Warren were current. The first two populations that were viewed as native are no longer extant. *Filipendula rubra* was initially listed as a historical species in New Jersey and at one point it was thought to be extirpated, but a new population was recently discovered in the northern part of the state (NJONLM 1992, NJNHP 2016 & 2024).

Threats

Aspinwall and Christian (1992a) attributed the rarity of *Filipendula rubra* to a paucity of suitable habitat. In addition their intrinsic scarcity in the landscape, fens and other high quality wetlands are often destroyed or degraded by anthropogenic changes in hydrology or water quality that alter the community characteristics or hasten natural successional processes (O'Connor and Penskar 2007, Dolan et al. 2011, Johnson and Walz 2013, PANHP 2019). Habitat loss and fragmentation have been identified as a significant threat to *F. rubra* (NatureServe 2024). Nekola (1994) reported that the species had been extirpated by habitat destruction in the northeastern part of Iowa, and one population in New Jersey was eliminated by a combination of succession, drainage, and clearing for the installation of a fence (NJNHP 2024). However, there are some indications that *F. rubra* can tolerate certain types of low level disturbances such as the grazing of livestock or limited ditching (Orzell 1983).

Mature *Filipendula rubra* plants are thought to be competitive (Robison and White 1987) but the establishment of seedlings may be deterred by dense growth of other herbaceous flora (Aspinwall and Christian 1992a). Succession is likely to threaten Queen-of-the-Prairie populations: Heus (2003) noted that the species required a "near absence of woody plants" and Connor and Penskar (2007) underscored the importance of controlling the growth of shrubs in its habitat.

Due to its popularity with gardeners, the collection of *Filipendula rubra* has been identified as an occasional concern (PANHP 2019). Miller et al. (1992) listed *F. rubra* as a plant species that may be utilized by White-tailed Deer. Schuler (2005) observed that the Japanese Beetle (*Popillia japonica*) was feeding on the inflorescence and leaves of the species, and that the damage was extensive enough to reduce seed production. Severe infestations of *P. japonica* can be devastating—the adults destroy leaves, flowers and fruit while the larvae feed on the roots, causing discoloration, wilting, or death of the plants (UGAE 2024). A rust (*Triphragmium ulmariae*) has been documented on *Filipendula rubra* but the fungus is extremely rare in North America, where it has apparently only been found at two sites (Jackson 1920, McCain and Hennen 1981). *F. rubra* is also susceptible to *Podosphaera filipendulae*, a powdery mildew

(Aime and Abbasi 2022). While damage from powdery mildews is mainly cosmetic, severe infections can reduce plant vigor or result in death (Douglas undated).

Climate Change Vulnerability

Some of the effects of changing climactic conditions in New Jersey include higher temperatures, a longer growing season, and shifting precipitation patterns which have increased the frequency and intensity of both droughts and floods (Hill et al. 2020). An evaluation by Ring et al. (2013) determined that *Filipendula rubra* was moderately vulnerable to climate change in New Jersey. The primary risk factor identified was alteration of natural hydrologic patterns—fens themselves are considered highly vulnerable to climate change (Johnson and Walz 2013). A similar assessment in Illinois concluded that *F. rubra* was extremely vulnerable in that state (Molano-Flores et al. 2019).

A study of plants in a rain garden in Poland indicated that *Filipendula rubra* has some tolerance for extended periods of either wet or dry weather (Burszta-Adamiak et al. 2023). However, the species does not appear to be capable of withstanding extremes. *F. rubra* generally responds poorly following lengthy exposure to hot, dry conditions (Thomas and Schrock 2004, Leopold 2005), and the loss of an Illinois population between 2013 and 2018 was attributed to a series of severe floods (Murphy et al. 2021). *F. rubra* may be better able to adapt to rising temperatures. For example, Queen-of-the-prairie appears to have advanced its blooming time in response to the warming climate (Conover and Pelikan 2010). The seeming ease with which *F. rubra* became naturalized in many of the northern states and provinces where it was introduced suggests that the species might be able to shift its range northward as conditions continue to change.

Management Summary and Recommendations

No management needs have been identified for New Jersey's sole extant population of *Filipendula rubra* (NJNHP 2024). However, the occurrence was only discovered recently and it has not yet been formally assessed. When the initial status evaluation is conducted, particular note should be taken of habitat conditions and potential threats.

In certain places where it occurs, *F. rubra* may benefit from the deterrence of woody plant succession (PANHP 2019). Hitchmough and Woudstra (1999) indicated that fall mowing was an effective way to maintain suitable habitat for the species. Heus (2003) conjectured that the habitat of a Virginia population was likely maintained by fire in the past. There is some anecdotal evidence that burning can stimulate clonal growth, germination, and seedling establishment in *F. rubra* (O'Connor and Penskar 2007), but the technique cannot be endorsed at present because the effects of fire on the species have not been studied.

The distribution of *Filipendula rubra* is something of a paradox because the plant is rare throughout much of its natural range yet widely established in areas where it is not native (see Figure 4). The dispersal mechanisms and establishment requirements of *F. rubra* should be a priority for research. Another potential topic for investigation—whether there are regional

variances in the species' degree of self-incompatibility—was recommended by Aspinwall and Christian (1992b).

Synonyms

The accepted botanical name of the species is *Filipendula rubra* (Hill) B. L. Rob. Some orthographic variants, synonyms, and common names are listed below. Some of the listed synonyms also included one or two named varieties (ITIS 2024, POWO 2024, USDA NRCS 2024b).

Botanical Synonyms	Common Names
Filipendula lobata (Gronov. ex Jacq.) Maxim.	Queen-of-the-prairie
Spiraea lobata Gronov. ex Jacq.	Queen of the Prairie
Spiraea palmata L.	
Spiraea rubra (Hill) Britton	
Thecanisia angustifolia Raf.	
Thecanisia lobata (Gronov. ex Jacq.) Raf.	
Thecanisia purpurea Raf.	
Ulmaria lobata Kostel. ex Maxim.	
Ulmaria rubra Hill	

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