Crataegus pennsylvanica

Pennsylvania Hawthorn

Rosaceae

Crataegus pennsylvanica by Nadiatalent 2008, CC BY-SA 4.0

***Crataegus pennsylvanica* 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

Crataegus pennsylvanica (Pennsylvania Hawthorn) is a woody plant in the rose family. Pennsylvania Hawthorn typically grows as a tree 5–10 meters in height but younger plants may be shrubby. Twigs on the more vigorous shoots are usually armed with a few thorns that are 3–5 cm long. The leaves have both shallow lobes and sharp teeth, and they are 6–12 cm long and widest below the middle. New leaves are densely pubescent but older leaves only have hairs along the veins on the undersides. Toothed stipules may encircle the stems below the leaves. The leaves are slightly tinged with red when first unfolding but they are more than half grown by the time the flowers open. *C. pennsylvanica* flowers in May or sometimes in June. The inflorescences contain clusters of 8–20 flowers that can approach 2 cm in diameter with 5 white petals and 5–10 pale pinkish stamens. The flowering stems are hairy, as are the basal parts of the flowers, and the sepals and subtending bracts have glandular teeth. The fruits are bright red pomes 10–12 mm in diameter on which the persistent sepals are prominently displayed. Each fruit contains 4–5 hard-coated nutlets (pyrenes). (See Ashe 1902, Sargent 1922, Fernald 1950, Rhoads and Block 2007, Phipps 2012, Weakley 2015, Phipps 2020).


New leaves with stipules in June and fruits in September by Nadiatalent, 2015, CC BY-SA 4.0.

Numerous species of *Crataegus* have been named, and the identification of hawthorns has been further complicated by hybridization and polyploidy within the genus and morphological variation within some of the species (Fernald 1950, Gleason and Cronquist 1991, Macklin 2001). *Crataegus* may include anywhere between 150 and 1200 species depending on the way different authors have interpreted species boundaries (Vašková and Kolarčik 2019). Gleason and Cronquist (1991) identified 65 possible hybrids in the northeastern United States, but Phipps (2005) considered hybridization to be relatively uncommon in North America and recently recognized only 17 hybrids for the entire continent (Phipps 2020). Authors have often managed the unwieldy number of hawthorns by subdividing the genus into subgroups. Macklin (2001) transferred *Crataegus pennsylvanica* from series *Coccineae* to series *Molles*, noting that the species appeared to be intermediate between the two groups. The most current system separates the genus *Crataegus* into sections which are further divided into series, and *C. pennsylvanica* has

been placed in section *Coccineae* series *Molles* (Phipps 2020). Recognition of some hawthorns may require both young and mature leaves along with flowers and fruit, so species identification is often provisional when all of the necessary characteristics cannot be observed (e.g. Comas et al. 2014, Block and Skema 2016).

As a consequence of the taxonomic confusion, much of the literature devoted to *Crataegus* has been focused on classification. An unfortunate side effect of the emphasis on taxonomy is limited knowledge regarding the life history and ecology of many hawthorns, particularly in regard to the less common species. Many researchers have focused their efforts on widespread or recognizable species, presented information with cautionary notes regarding tentative species identification, or reported results only at the genus level.

Pollinator Dynamics

Crataegus flowers contain trimethylamine, a substance which also occurs in decaying organisms. The chemical has a low odor detection threshold, meaning that the scent is noticeable even at very low concentrations (Mitchell and Smith 2016), and the floral odor has been described as reminiscent of rotten fish (Wicke 1854). Many species of hawthorn are pollinated by midges, which are attracted by the "unpleasant fishy smell" of the flowers (Genders 1977). Wicke (1854) observed that chemical concentrations were highest in mature buds and fresh flowers but gradually dissipated as the flowers aged.

Insect pollination of *Crataegus* flowers is not limited to midges. Other kinds of flies are also attracted by the putrid smell of blooming hawthorns (Thomas et al. 2020) and at least ten fly species have been documented on *C. monogyna* flowers (Corbet et al. 1979). Gyan and Woodell (1987) reported that freshly opened flowers of *C. monogyna* were rejected by foraging insects but later visitors included honeybees and bumblebees. Some butterflies have also been known to visit *C. monogyna* flowers (Power and Stout 2011). *Crataegus* flowers have nectaries, and a four-day period of nectar secretion was reported for *C. crus-galli* and *C. coccinea* (Weryszko-Chmielewska et al. 2003). Sugar concentrations in the nectar can fluctuate throughout the day, resulting in different suites of insect visitors at different times (Corbet et al. 1979, Thomas et al. 2020). Fertilization rates of hawthorns have been improved by the presence of other simultaneously-blooming flora that increase the number and diversity of pollinators in the vicinity (Power and Stout 2011, Kovács-Hostyánszki et al. 2013).

Self-compatibility varies within *Crataegus* (Dickinson and Phipps 1986). Some members of the genus can produce at least a portion of their seeds from unfertilized ovules, and experimental work demonstrated that all species in *Crataegus* series *Coccineae* were able to develop seeds via self-pollination (Macklin 2001). In *C. monogyna* a comparable number of pollen tubes developed following outcrossing and self-fertilization but fruit set was lower in self-pollinated plants, suggesting the possibility of post-zygotic embryo selection (Chacoff et al. 2008).

Seed Dispersal

Crataegus pennsylvanica fruits ripen during September or early October (Rhoads and Block 2007, Weakley 2015, Phipps 2020). Frugivorous birds are important dispersers of hawthorn seeds. *Crataegus* pomes are relatively low in food value so although the fall fruiting time of *C. pennsylvanica* coincides with peak migration, consumption and dispersal is likely to continue into the winter months because migrating birds selectively favor fruits from plant species that offer higher nutritional rewards (Stiles 1980). Birds that are winter residents generally disperse seeds in a smaller area. Dispersal has been studied in *Crataegus monogyna*, which also has red pomes and is primarily bird-dispersed (Guitán and Fuentes 1992). Birds are preferentially attracted to trees with numerous fruits, larger fruits, and high pulp-to-pyrene ratios (Sallabanks 1993). Sobral et al. (2010) reported similar avian preferences, adding that birds appear to select fruits based on width rather than length because wider fruits are likely to have more pulp and shorter seeds. A number of mammals can also consume hawthorn fruits and disperse the seeds, including black bears, raccoons, foxes, coyotes, martens, and skunks (Willson 1993). Following dispersal, *Crataegus* seeds often need a period of warm stratification followed by a period of cold stratification before they can germinate so it may take two or more years for germination to occur (Brinkman 1974, Deno 1993, Block and Skema 2016).

Habitat

Crataegus pennsylvanica is typically found growing in open woodlands and shrublands at elevations from 10–200 meters (Latham 2003, Weakley 2015, Phipps 2020). Latham (2003) described *C. pennsylvanica* as a somewhat ruderal species, and it sometimes establishes in successional fields or along fencerows (Phipps 2020). New Jersey's population is situated in a dry, rocky, open woodland adjacent to a utility right-of-way (NJNHP 2022), and the habitat of one Ohio occurrence was described as moist woods (Terrell 1955).

Hawthorns can be useful for stabilization and erosion control because they are generally able to tolerate a wide variety of conditions (Brinkman 1974). *Crataegus pennsylvanica* has been characterized as easy to cultivate because it can grow in diverse soil types and, once established, is able to tolerate both excessive moisture and drought. Fruit yields and quality are highest when the plants are growing in full sun (PFAF 2022).

Some species of *Crataegus* are known to form mycorrhizal associations (Harley and Harley 1987, Wang and Qiu 2006, Thomas et al. 2020). Comas et al. (2014) found mycorrhizae in a species that was identified as "probably *Crataegus pennsylvanica*".

Wetland Indicator Status

Crataegus pennsylvanica 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).

USDA Plants Code (USDA, NRCS 2022)

CRPE3

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

The global range of *Crataegus pennsylvanica* is limited to the eastern United States and Canada (POWO 2022). The map in Figure 1 depicts the extent of Pennsylvania Hawthorn in the North America.

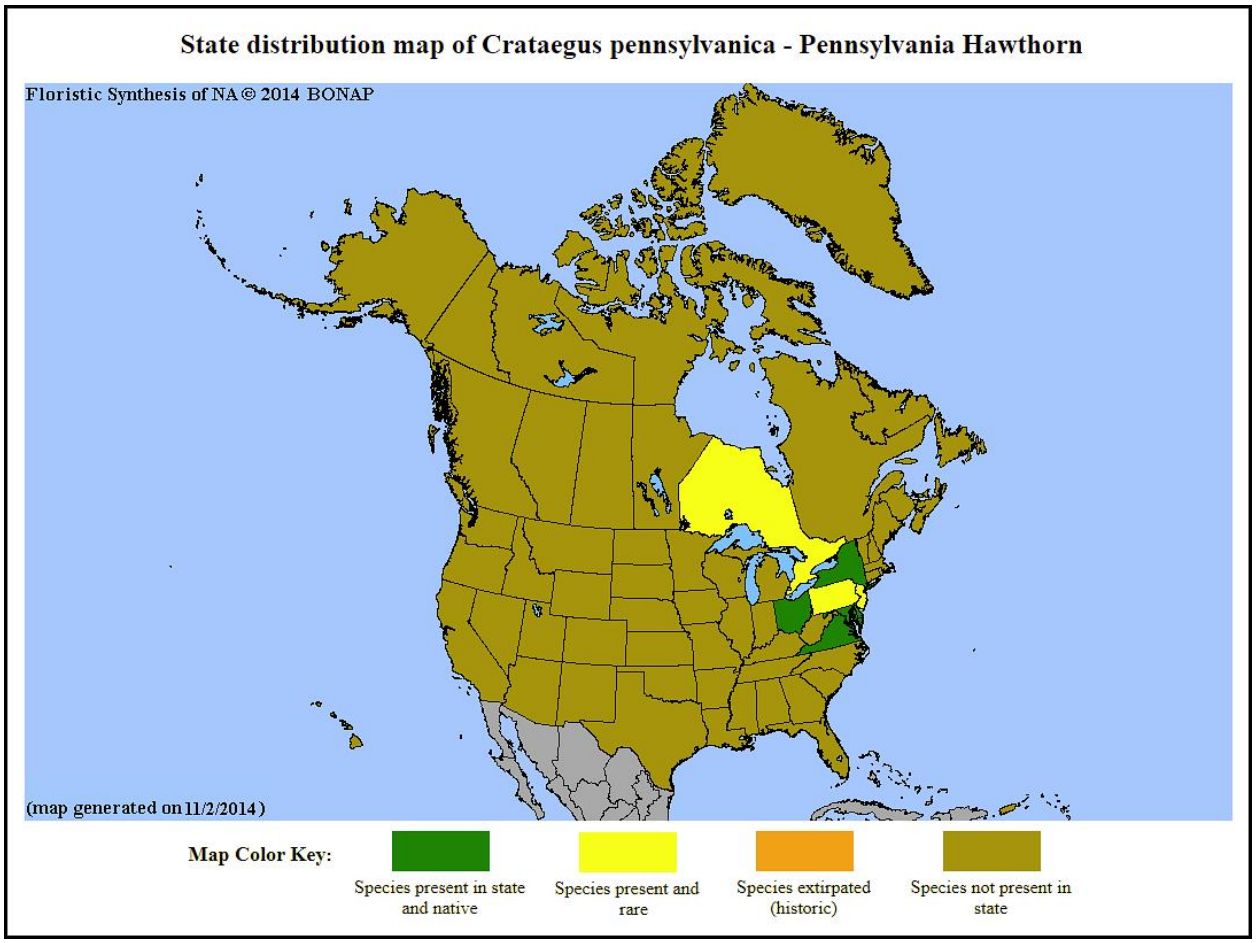

Figure 1. Distribution of C. pennsylvanica in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2022) shows records of *Crataegus pennsylvanica* in one New Jersey county: Sussex County (Figure 2). The map is consistent with the current known distribution of the species.

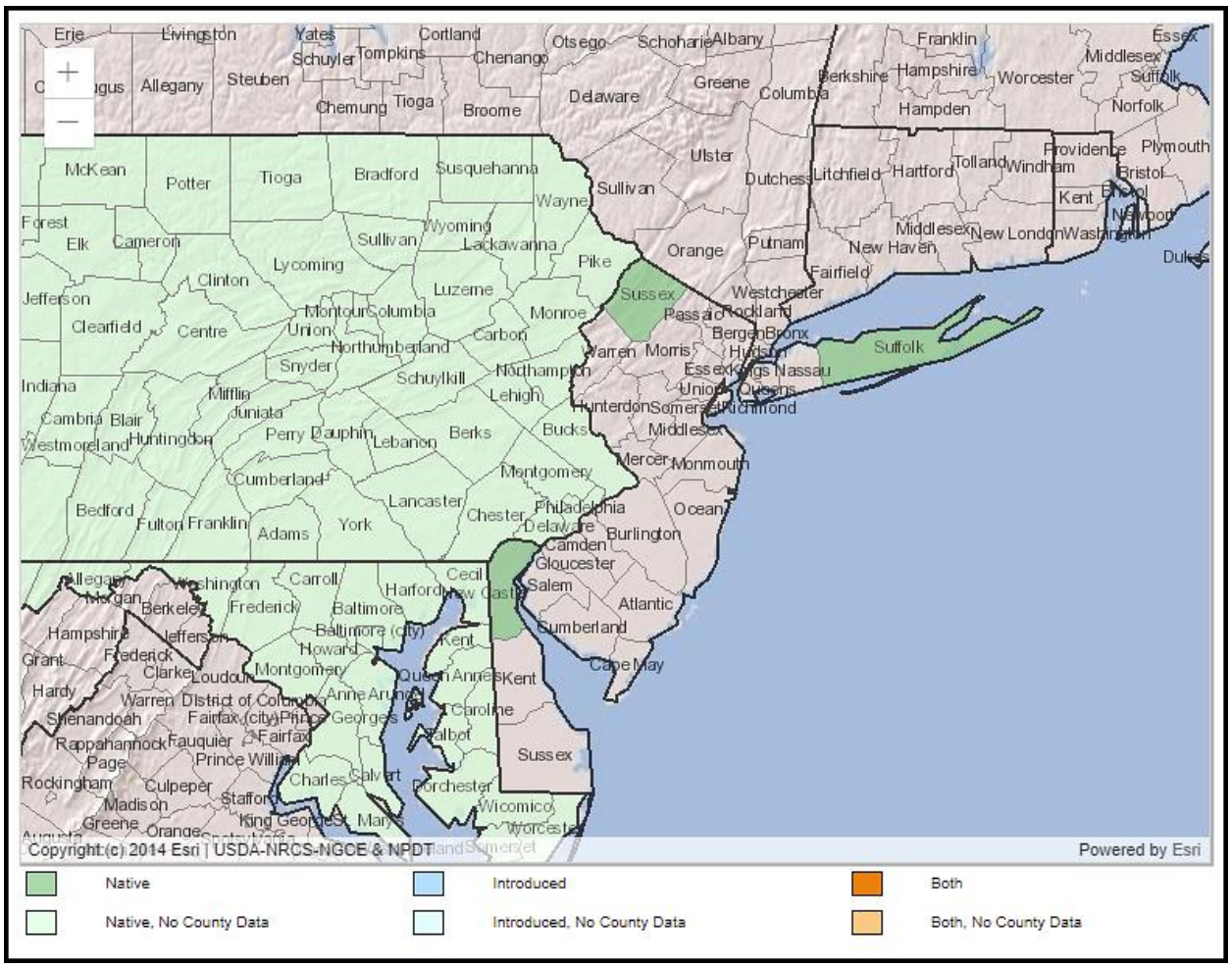

Figure 2. County records of C. pennsylvanica in New Jersey and vicinity (USDA NRCS 2022).

Conservation Status

Crataegus pennsylvanica is globally vulnerable. The G3 rank means the species has a moderate risk of extinction or collapse due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors (NatureServe 2022). The map below (Figure 3) illustrates the conservation status of *C. pennsylvanica* throughout its range. The species is critically imperiled (very high risk of extinction) in three states and one province, imperiled (high risk of extinction) in one state, and unranked in four other states where it has been recorded. In the North Atlantic region, which includes four Canadian provinces and twelve U. S. states, *Crataegus pennsylvanica* has been identified as likely to warrant a high conservation priority although it is currently unrankable. Species may be unrankable due to lack of information or due to substantially conflicting information about status or trends (Frances 2017).

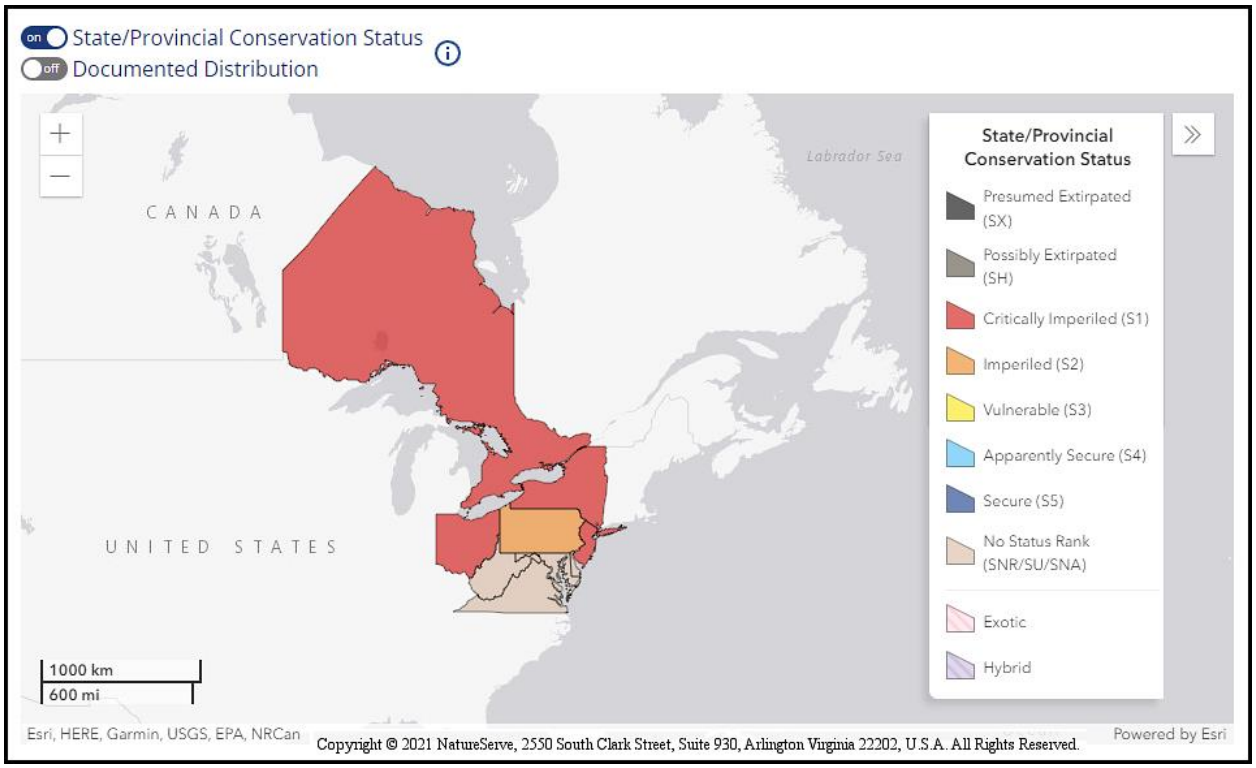

Figure 3. Conservation status of C. pennsylvanica in North America (NatureServe 2022).

Crataegus pennsylvanica 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. A regional status code of HL has also been assigned to *C. pennsylvanica*, signifying that the species is eligible for protection within the jurisdiction of the Highlands Preservation Area (NJNHP 2010). The New Jersey occurrence was discovered by David Snyder in 1993 and is a small but apparently viable population (NJNHP 2022).

Threats

New Jersey's only known occurrence of *Crataegus pennsylvanica* consists of several large trees and a few scattered shrubs (NJNHP 2022), so the loss of any plants could be detrimental to the viability of the population. A number of other trees in the immediate vicinity of the *C. pennsylvanica* plants have been cut down—some during the course of roadside management and at least one by a beaver (Block and Skema 2016). It is unclear whether either human or beaver activities pose a threat to the Pennsylvania Hawthorns at the site.

Because *Crataegus pennsylvanica* prefers locations with an open or semi-open canopy and reproduces more vigorously in sunny sites, succession can threaten the persistence of some populations. Despite the species' ability to establish in sites that have been altered by human activities, the rarity of *C. pennsylvanica* in a region with a rich disturbance history indicates that factors other than habitat availability limit its success.

Crataegus pennsylvanica is generally untroubled by pests and diseases, and most members of the genus are even able to tolerate some atmospheric pollution (PFAF 2022). Mature *C. pennsylvanica* trees may be able to endure some of the extreme weather conditions that result from climate change, which in New Jersey could include droughts or floods (Hill et al. 2020). However, rising temperatures might affect the hawthorn's ability to reproduce. Flowering in *Crataegus* is triggered by temperature. Macklin (2001) found that hawthorns growing in cooler depressions flowered later than those situated upslope, south-facing branches bloomed before north-facing branches on the same tree, and flowers at the tops of trees opened earlier than those on lower branches. As the climate becomes warmer, temperature-sensitive species may bloom earlier in the season which could result in a loss of synchronicity with key pollinators.

Management Summary and Recommendations

Development of a site-specific management plan is recommended for New Jersey's only population of *Crataegus pennsylvanica*. An onsite threat assessment is needed to ascertain whether the extant trees are threatened by beavers or by maintenance activities that may be conducted in the adjacent right-of-way or along a nearby road. If necessary, selective removal of other canopy species growing in close proximity could promote flowering and fruit development in the Pennsylvania Hawthorn plants.

Research is needed in order to provide a foundation for the conservation of *Crataegus pennsylvanica* throughout its range. Little information was found that could be applied to the species with certainty. Although some likely ecological relationships can be inferred from studies of other hawthorns, *Crataegus* is a large genus with variable characteristics and a significant number of understudied species. Research on any facet of the life history of *C. pennsylvanica* is likely to yield useful knowledge but studies of topics that could provide insight into the causes of the species rarity could prove to be particularly valuable. Such subjects could include different aspects of reproduction, dispersal, establishment, and competitive ability.

Because *Crataegus pennsylvanica* is globally vulnerable, offsite propagation and reintroduction may be an appropriate line of investigation. While information regarding seed collection, storage, germination, and cultivation is available for many hawthorns (e.g. Brinkman 1974, PFAF 2022) much of the work has taken place in nurseries or gardens. Before ex situ propagation and transplantation can be considered as a means of maintaining *C. pennsylvanica*, more information is needed about how the species establishes and persists under natural circumstances.

Synonyms

The accepted botanical name of the species is *Crataegus pennsylvanica* Ashe. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA NRCS 2022, POWO 2022).

Botanical Synonyms

Crataegus tatnalliana Sarg.
Crataegus albicans var. *tatnalliana* (Sarg.) Farw.
Crataegus polita var. *tatnalliana* (Sarg.) Eggl.

Common Names

Pennsylvania Hawthorne

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