

***Pyrus calleryana* Decne. – Callery Pear, Bradford Pear**

Synonyms: *Pyrus koehnel* C.K. Schneid., *Pyrus kawakamii* Hayata

Taxonomy

Family: Rosaceae



Figure 1. Callery Pear. Photo by K Frost

Callery Pear is a small, deciduous tree native to eastern Asia. It was brought to the United States in the early 1900s as a species resistant to fire blight that was affecting pear trees across America. Many cultivars have been developed from it; Bradford Pear is one of the best-known cultivars, but there are several. The tree blooms prolifically in the spring with white blossoms before the leaves emerge. The leaves are glossy green all summer and, depending on the variety, turn a glowing burgundy or yellow in the fall. The trees cannot self-pollinate, but if there is more than one cultivar in an area, they will produce copious small, hard, green fruit. It is well known for having nasty smelling flowers, that are variously described as rotting fish, perfume gone wrong, or dirty baby diapers.

Native Region or Range

This species is native to eastern Asia, including China, Japan, and Korea. In China, it was collected from a range of habitats. Its native range in China most closely matches the range from Illinois to Virginia and south to Louisiana and Florida (Culley and Hardiman 2007).

History

The first record in the United States of Callery Pear were trees planted at Arnold Arboretum in Jamaica Plains, MA by E.H. Wilson in 1908 (Vincent 2005). *P. calleryana* was researched for its resistance to fire blight that attacks common pear (*Pyrus communis*). Fire blight, caused by a bacterium (*Erwinia amylovora*) and thought to be spread by pollinators in pear orchards, had affected over 80% of the annual pear crop in the early 1900s by killing the trees. A search for resistant pear species indicated that *Pyrus calleryana* was mostly resistant, but there were few plants available. Frank Reimer of the Southern Oregon Experiment Station requested USDA plant explorer Frank Meyer to collect 100 lbs. of seed in China for additional testing of resistance in different genotypes. (Culley and Hardiman, 2007; Vincent, 2005). Meyer noted the wide variation in habitats where the species occurred in China, including its tolerance for a wide range of environmental conditions. Following his travels in Yichang, China in 1918, he wrote:

Pyrus calleryana is simply a marvel. One finds it growing under all sorts of conditions; one time on dry, sterile mountain slopes; then again with its roots in standing water at the edge of a pond; sometimes in open pine forest, then again among scrub on blue-stone ledges in the burning sun; sometimes in low bamboo-jungle...and then again along the course of a fast-flowing mountain stream or on the occasionally burned-over slope of a pebbly hill. The tree is nowhere found in groves; always as scattered specimens, and but very few large trees were seen. (Culley and Hardiman, 2007, quoted Meyer's 1918 Typescript).

The seed collected from eastern Asia were planted over several hectares to test for the most fire blight resistant variety. These were planted in Oregon and in Maryland. In the 1950s, one particularly vigorous, thornless individual was recognized as a potential ornamental variety. Cuttings of it were grafted onto root stock of other *P. calleryana* seedlings and planted out to a treeless housing subdivision in Maryland. After 8 years, these were determined to be a success and the "Bradford" cultivar was named. It became commercially available in 1962. Other Callery Pear cultivars were also developed at both the Glenn Dale station in Maryland and in Oregon. Other cultivars continue to be developed by private efforts now. (Culley and Hardiman 2007; Vincent 2005)

Biology

Life form:

- perennial tree species that lives approximately 60 years, reaching a height of 30 to 60 feet (depending on the cultivar)
- Blooms with white petaled flowers in early spring before the leaves have fully expanded
- Has 2 to 3 styles and glabrous hypanthium (compared to 5 styles and a pubescent hypanthium in *Pyrus communis*)
- Pomes are 0.9 to 1.5 cm in diameter, dark in color
- Anthers are pink to red
- Some cultivars have thorns, some do not.
- Stemmed leaves are dark green, mostly glabrous, with low teeth, approximately 40-80 mm long by 35-60 mm wide
- leaves can be deltate or acuminate and might be confused with poplar

Naturalized: Yes

Dispersal:

- Numerous small fruits attractive to birds and small mammals easily dispersed
- Hundreds of fruits produced on each tree, each with 2 to 10 seeds

- Self-incompatible – gametophytic self-compatibility, requires at least 2 cultivars (Bradford pear and another cultivar) or two related species (*P. calleryana* and *P. communis*) to cross-pollinate. Cultivars are clones of one tree.
- Seedlings take approximately 3 years of growth to start to flower and produce seeds.

Habitats:

- Extremely variable. See quote from Meyer above. Wetlands, old fields, dry slopes, acidic or alkaline soils.

Disease and herbivory:

- Callery pear is resistant to many diseases, including the fire blight. It is also resistant to Japanese beetles (*Popillia japonica*)
- White-tailed deer and other herbivores will browse on this species

Reported Invasiveness

Callery pear has been listed as invasive in several states, including ones that are south and north of Massachusetts.

- Listed as invasive in Ohio, April 2018 – no longer allowed to plant after Jan 1, 2023
- Listed as invasive in Pennsylvania, Nov 2021, no sales after Nov 2024
- Listed as invasive in South Carolina, banned October 1, 2024.
- Listed as invasive in Maine 2022, no sales after Jan 2024
- Listed as invasive in Delaware, March 17, 2021; no sales after July 1, 2022

Distribution

Callery Pear has been reported in 38 states in EDDMapS (see figure 2 on following page). As of August 2022 in Massachusetts, there were 15 confirmed reports in EDDMapS, with records in Essex, Middlesex, Worcester, Norfolk, and Plymouth counties. iNaturalist has over 200 observations in Massachusetts (Figure 3), but these are a mix of planted and escapees from cultivation into natural areas. For this species in iNaturalist, it is difficult to tell which are planted and which are escapees unless the observer has put a comment on the observation saying it is not planted. I have reviewed all the records in iNaturalist and marked ones that are clearly planted as such. The observations in iNaturalist span all but three counties in the state, Bristol, Franklin, and Berkshire indicating the species is growing across Massachusetts.

The Consortium of Northeastern Herbarium has 16 specimens of Callery Pear, with three from Arnold Arboretum in Suffolk County, two in Worcester County, three in Dukes County, two in Franklin County and four from Hampden County. The ones from Arnold Arboretum likely represent cultivated individuals while the other records all represent plants that have seeded into minimally managed lands, including roadsides.

Spread and Impacts:

Callery pear will grow in a variety of different habitat conditions. When mown, it forms dense stands completely shading the ground beneath it, thus preventing growth of herbaceous species and smaller shrubs. It will resprout after fire.

David Coyle, PhD., Assistant Professor at Clemson University in Extension in forest health and invasive species, describes the situation in South Carolina, “There is a lot of research that shows that where you have a diverse urban canopy, you have much more wildlife — more birds and more insects for the birds

to eat. It's just a much better, healthier ecosystem without those Bradford pears in there. Everywhere you've got a Bradford pear, it's like a food desert to a bird." South Carolina has programs providing native trees to landowners that bring documentation they removed Bradford pears (or other Callery pears) from their property.

Figure 2. EDDMapS State Records of Callery Pear in the United States

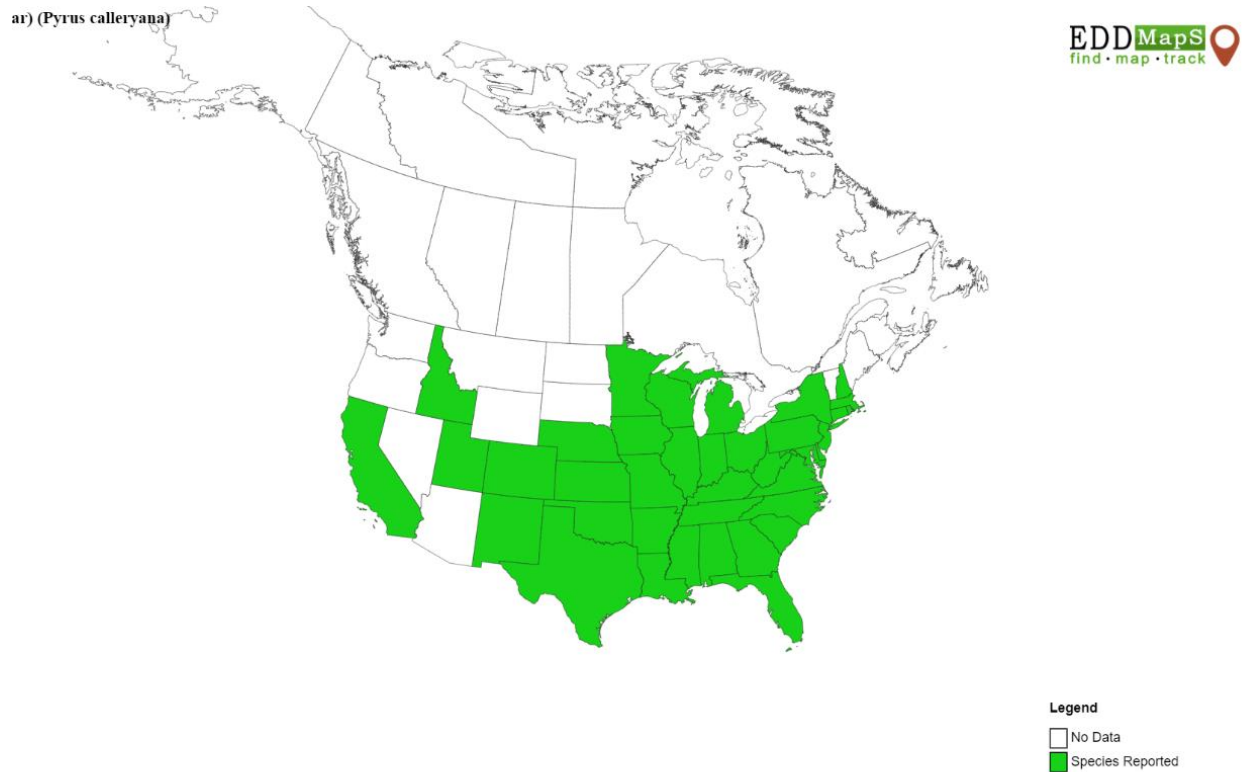
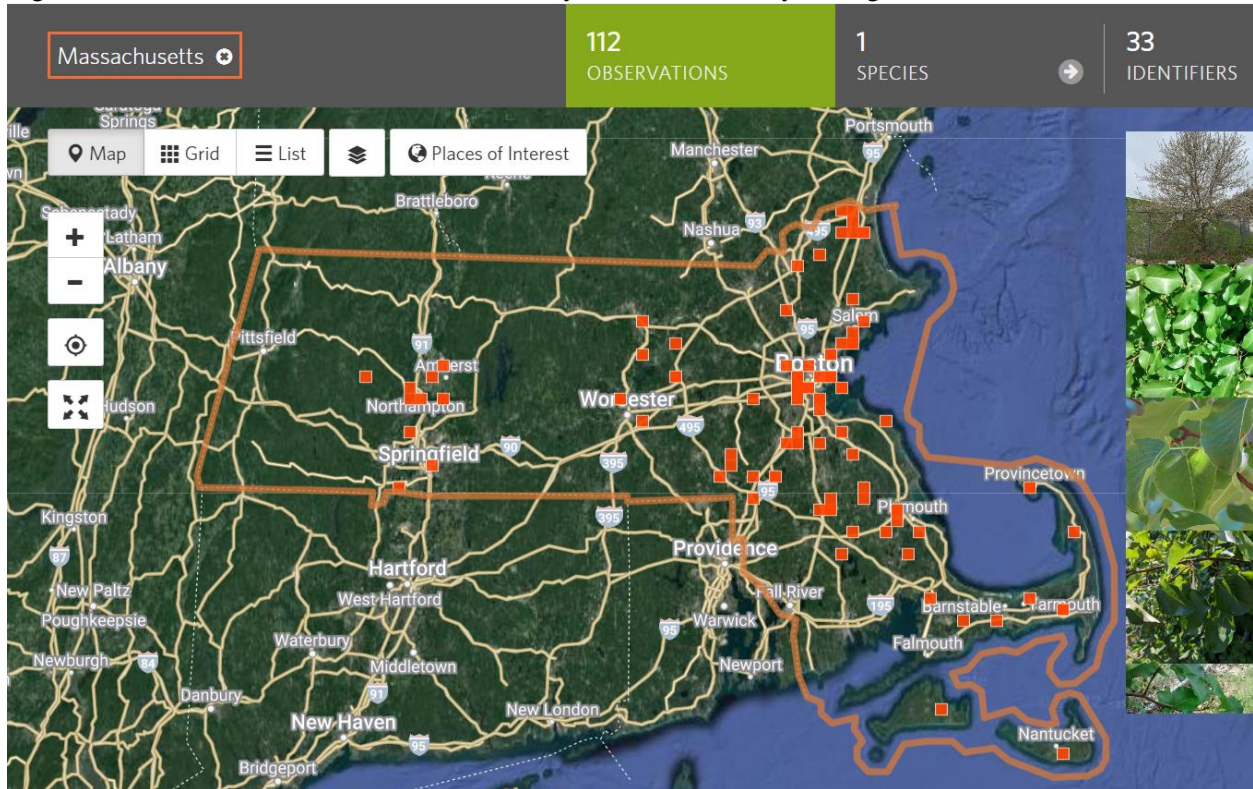


Figure 3. Verified iNaturalist Records of Callery Pear in minimally managed areas in Massachusetts



References

- AP News via WCVB5, April 22, 2022. Popular landscaping trees now have invasive spawns. They have spikes that can flatten tractor tires. Accessed 2-24-2022.
- Clemson News. “Clemson brings battle against invasive Bradford pear trees to state’s capitol.” October 14, 2021. <https://news.clemson.edu/clemson-brings-battle-against-invasive-bradford-pear-trees-to-states-capital/> Accessed 8-16-2022.
- Connolly, Bryan A. and Katana Boutiette. 2020. A likely *Pyrus X Calleryana X Communis* (Rosaceae) Hybrid Found in Connecticut. *Rhodora* 122 (990).
- Culley, Theresa M. and Nicole A. Hardiman. 2007. The Beginning of a New Invasive Plant: A History of the Ornamental Callery Pear in the United States. *BioScience*. Vol. 57 (11): 956–964
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- EDDMapS. 2022. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at <http://www.eddmaps.org>. Accessed 8-15-2022.
- Flora of North America www.efloras.org accessed 4-22-2022

FNA references: Culley, T. M. and N. A. Hardiman. 2007. The beginning of a new invasive plant: A history of the ornamental Callery pear in the United States. *BioScience* 57: 956–964.

Herbarium specimen data provided by: George Safford Torrey Herbarium (CONN), University of Connecticut; Herbarium of the Arnold Arboretum (Harvard University Herbaria); New England Botanical Club Herbarium (NEBC) Harvard University; The Polly Hill Arboretum Herbarium; University of Massachusetts Amherst, Herbarium; Westfield State University Herbarium (Accessed through the Consortium of Northeastern Herbaria web site, www.neherbaria.org, 2022-08-16)

Higgins, A. 2018. [Scientists thought they had created the perfect tree, but it became a nightmare](#). The Washington Post. 5/29/2019. Accessed 6/1/2022.

iNaturalist. *Pyrus calleryana* observations within Massachusetts. Available at https://www.inaturalist.org/observations?place_id=2&subview=map&taxon_id=119793. Accessed 8-23-2022.

Invasive Plant Atlas of the United States <https://www.invasiveplantatlas.org/subject.html?sub=10957>
Accessed 2-22-2022.

Native Plant Trust, 2022. Go Botany website:
<https://gobotany.nativeplanttrust.org/species/pyrus/calleryana/> accessed 6/1/2022.

Vincent, M. A. 2005. On the spread and current distribution of *Pyrus calleryana* in the United States. *Castanea* 70: 20–31.

Information compiled by Karro Frost, Massachusetts Natural Heritage & Endangered Species Program, 2022.

SPECIES: *Pyrus calleryana* Decne.

STATUS: Likely Invasive

NON-NATIVE INVASIVE PLANT WORKSHEET

MASSACHUSETTS CRITERIA FOR EVALUATING NON-NATIVE PLANT SPECIES FOR INVASIVENESS.

The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as “*non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.*” As defined here, “species” includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

The following criteria are being used to objectively evaluate and categorize plant species suspected of being, or with the potential to become, invasive in Massachusetts. They were developed by the George Safford Torrey Herbarium at the University of Connecticut and a subcommittee of the Massachusetts Invasive Plant Group representing science, nursery, and conservation professionals.

The criteria enable the separation of plants into the following categories:

- Invasive Plants in Massachusetts
- Likely Invasive Plants in Massachusetts
- Potentially Invasive Plants in Massachusetts (species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth)

For a species to be included on the list of species determined to be **Invasive, Likely Invasive or Potentially Invasive** in Massachusetts, it must be substantiated by scientific investigation (including herbarium specimens, peer-reviewed papers, published records and other data available for public review) to meet specific criteria. The process of reviewing individual plant species for their invasiveness in Massachusetts is ongoing and may result in a change in status pending new data and further review.

Tabular summary of criteria to be met

	Criteria that must be met
Base criteria	1-4
Invasive	1-9
Likely Invasive	1-5, at least one of 6-9, at least one of 10-12
Potentially Invasive	1-4 (not 5), 13-15

Species: *Pyrus calleryana* Decne.

For a species to be designated as “INVASIVE,” “LIKELY INVASIVE” or “POTENTIALLY INVASIVE” it must meet certain base criteria (#1-4 below). The species must:

1. Be nonindigenous to Massachusetts.

Yes No

Comment: This plant is native to eastern Asia, including China, Taiwan, Korea, Japan and Vietnam (Connolly and Boutiette 2020, Native Plant Trust, 2022, Culley and Hardiman 2007).

2. Have the biologic potential for rapid dispersion and establishment in minimally managed habitats

Yes No

*Comment: Although an individual cultivar cannot self-pollinate, once other cultivars of *P. calleryana* are planted in the same vicinity, they can and do cross with each other. There are several cultivars. As trees they produce 100s of fruits per tree each year, that often are eaten and spread into unmanaged areas by birds (Culley and Hardiman 2007).*

3. Have the biologic potential for dispersing over spatial gaps away from the site of introduction.

Yes No

*Comment: Wild trees grow quickly and flower prolifically at an early age (after approximately three years of growth, they start to flower). They produce fruit that is dispersed into other areas by birds provided there is more than one cultivar of *P. calleryana* in the area (Culley and Hardiman 2007).*

4. Have the biologic potential for existing in high numbers away from intensively managed artificial habitats

Yes No

Comment: When the Bradford pear cultivar was first planted out across the country in the 1950s, it was the first and only cultivar of this species planted and it did not produce viable seed. Now many cultivars have been planted and they cross-pollinate each other, producing 100s of fruits per tree; each fruit contains between 2 to 10 seeds. These fruits are eaten and spread by common birds such as European starlings and American robins. This species is more disease and pest resistant than other pear species. For example, Culley and Hardiman (2007) note that Bradford pear is resistant to Japanese beetles.

If a species does not meet all four of the previous criteria, stop here. The species cannot be listed at this time. If a species meets all four, go on to #5.

5. Be naturalized in Massachusetts (persists without cultivation in Massachusetts)

Yes No (note: include reference(s) and comments)

Comment: EDDMapS has verified reports of naturalized stands in Essex, Middlesex, Plymouth, Worcester, and Norfolk counties. iNaturalist has reports in those counties as well as some in Hampshire

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and Hampden Counties. Bertin et al. found established populations in Franklin County in Ashfield and Deerfield. The Consortium of Northeastern Herbaria also has additional records, documenting the species in Dukes and Suffolk counties.

If a species meets Criteria 1-4 and Criterion 5, it may be considered “INVASIVE” or “LIKELY INVASIVE” in Massachusetts. Go to Criteria 6-9.

If it does not meet Criteria 5, it may be considered “POTENTIALLY INVASIVE” if it meets Criteria 13-15.

6. Be widespread in Massachusetts, or common in a region or habitat type(s) in the state.

Yes No (note: include reference(s) and comments)

Comment: Based on descriptions on herbarium specimens found in the Consortium of Northeastern Herbaria, it is in several counties, though it is at high numbers mostly in open, somewhat disturbed areas such as along roadsides, or in old fields, etc. EDDMapS descriptions agree. iNaturalist locational information is not accurate to determine this usually.

7. Have many occurrences in MA that have high numbers of individuals in minimally managed habitats.

Yes No (note: include reference(s) and comments)

Comment: Callery Pear has been observed in many locations throughout the state, but I have not seen references to high numbers in places in Massachusetts. So far, it is in scattered locations. Other states to the south have reports of extremely high numbers; there are several news articles describing the difficulty of controlling the species in old fields once it is established in states to the south and mid-west. In its native range, Callery Pear occur in all types of habitats, on dry or wet soils. Frank Meyer, seed and plant collector for USDA and the Arnold Arboretum, wrote in 1918 during his collecting trip to Yichang:

*“*Pyrus calleryana* is simply a marvel. One finds it growing under all sorts of conditions; one time on dry, sterile mountain slopes; then again with its roots in standing water at the edge of a pond; sometimes in open pine forest, then again among scrub on blue-stone ledges in the burning sun; sometimes in low bamboo-jungle ... and then again along the course of a fast-flowing mountain stream or in the occasionally burned-over slope of a pebbly hill. The tree is nowhere found in groves; always as scattered specimens, and but very few large trees were seen.” (Culley, 2017)*

8. Be able to out-compete other species in the same natural plant community.

Yes No (note: include reference(s) and comments)

Comments: There are several news articles from the southern US and mid-west documenting Callery Pear out-competing native species and occurring in high numbers. Reports are from South Carolina, Indiana, Missouri, Ohio, Iowa and Pennsylvania. These trees can grow to 30 feet tall and create a dense canopy preventing light from reaching shorter plant species. Typical examples are these articles, first

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from USA Today: <https://www.usatoday.com/story/news/nation/2022/04/18/bradford-pear-trees-ban/7122246001/> and this from the Washington Post: https://www.washingtonpost.com/lifestyle/magazine/how-we-turned-the-bradford-pear-into-a-monster/2018/09/14/f29c8f68-91b6-11e8-b769-e3fff17f0689_story.html

9. Have the potential for rapid growth, high seed or propagule production and dissemination, and establishment in natural plant communities.

Yes No (note: include reference(s) and comments)

Comments: Callery pear start blooming when the plant is approximately 3 years old. If more than one cultivar is present, these trees will produce fruit from every blossom, each with 2 to 10 seeds. As the tree grows older, it produces hundreds of blooms, and hundreds of fruits. Fruit is transported by birds, who eat it and spread the seeds. As a non-native tree, there are no native caterpillars that feed on the tree, so it has no real controls on its population.

If a species meets the initial five Criteria and Criteria 6-9 it may be considered an “INVASIVE” species in Massachusetts.

If a species meets the initial five Criteria, but does not meet all of Criteria 6-9 at this time, it may be considered a “LIKELY INVASIVE” species in Massachusetts if in addition it meets at least one of the following three Criteria (#10-12).

10. Have at least one occurrence in Massachusetts that has high numbers of individuals forming dense stands in minimally managed habitats.

Yes No (note: include reference(s) and comments)

Comments: See response to question # 7 above.

11. Have the potential, based on its biology, colonization history outside its native range, and likelihood of range expansion or change in biologic potential from climate change predictions, to become invasive in Massachusetts.

Yes No (note: include reference(s) and comments)

Comments: As our temperatures warm, the Callery Pear becomes more likely to survive and thrive in Massachusetts. It cannot survive temperatures below -28° C (-18.4° F). It is currently recommended for planting in USDA Plant Hardiness Zones 5 to 9 (Culley 2017). Massachusetts consists of Zones 5 and 6, so currently on the edge of where this species thrives.

12. Be acknowledged to be invasive in nearby states but its status in Massachusetts is unknown or unclear. This may result from lack of field experience with the species or from difficulty in species determination or taxonomy.

Yes No (note: include reference(s) and comments)

Species: *Pyrus calleryana* Decne.

Comments: The following states have listed Callery Pear as invasive and already are or soon will be prohibiting sales:

Listed as invasive in Maine July 2022, no sales after Jan 2024

Listed as invasive in Pennsylvania, Nov 2021, no sales after Nov 2024

Listed as invasive in Ohio, April 2018, no longer allowed to plant after Jan 1, 2023

Listed as invasive in Delaware, no sales after July 1, 2022

Listed as invasive in South Carolina, sales banned October 1, 2024.

If the species meets the basic criteria for invasiveness (Criteria 1-4) but is not naturalized in Massachusetts (Criterion 5), the species may be considered “POTENTIALLY INVASIVE” in Massachusetts if it meets the following three criteria (#13-15):

Comments: N/A. It is already naturalized in Massachusetts and is spreading on its own.

13. The species, if it becomes naturalized in Massachusetts, based on its biology and biologic potential, would pose an imminent threat to the biodiversity of Massachusetts **and**

Yes No (note: include reference(s) and comments)

14. Its naturalization in Massachusetts is anticipated, **and**

Yes No (note: include reference(s) and comments)

15. The species has a documented history of invasiveness outside its native range including expansion of range and/or change in biological potential from climate change predictions.

Yes No (note: include reference(s) and comments)

References:

Connolly, Bryan A. and Katana Boutiette. 2020. A likely *Pyrus* X *Calleryana* X *Communis* (Rosaceae) Hybrid Found in Connecticut. *Rhodora* 122 (990).

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Initial evaluation completed:

Karro Frost, MA Natural Heritage & Endangered Species Program, August 2022.

Voted as **Likely Invasive** by MIPAG, 12-12-22*

**This evaluation used updated evaluation criteria voted on by MIPAG at the September 8, 2022 meeting.*

DEFINITIONS TO ACCOMPANY

“CRITERIA FOR EVALUATING NON-NATIVE PLANT SPECIES FOR INVASIVENESS IN MASSACHUSETTS”

Biologic potential - The ability of a species to increase its number, either sexually and/or asexually.

Invasive plants - Non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. *As defined here, “species” includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.*

Indigenous species - otherwise A species that occurs natively in Massachusetts. Indigenous species often have a pre-colonial presence (pre-1500) or have arrived in the region more recently without the aid of human intervention. Synonymous with native species.

Intensively managed habitats - Intensively managed habitats are habitats or land systems where management efforts and investments of time, money and labor occur frequently Examples include manicured lawns, landscaped grounds, gardens, roadsides or agricultural lands for crops or livestock.

Likely Invasive plants - non-native species that are naturalized in Massachusetts but meets some but not all (replaced following text: do not meet) the full criteria that would trigger an “Invasive plant” designation.

Minimally managed habitats - Minimally managed habitats are habitats where management efforts and investments of time, money and labor are infrequent or non-existent. These habitats may have been intensively managed for anthropogenic reasons at one time in their history. In some instances, management may be more intense, but management is done for conservation purposes and is primarily aimed at preserving elements of biological diversity such as imperiled species or critical natural communities. Minimally managed habitats are similar to "natural areas," but the distinction is made in order to remove bias, misconceptions or ambiguities that surround the term "natural area".

Non-indigenous species - A species that is not native or naturally occurring (based on its biology, phylogeny, distribution and current knowledge about the species) within Massachusetts. A species may be

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indigenous to North American but non-indigenous in Massachusetts. Synonymous with non-native species.

Naturalized species - A non-indigenous taxon that occurs without the aid and benefits of cultivation in Massachusetts. Further, it implies two biological points: it freely and regularly reproduces in the wild, sexually or asexually, and occurrences persist over time.

Natural plant community - A natural plant community is an association or assemblage of plant species that repeatedly occur together in reoccurring patterns in a specific type of habitat. This assemblage can be characterized by dominant species and biological properties. A natural plant community implies a minimally managed situation where all or most of the species that make up the assemblage are indigenous to the defined area.

Occurrence - Existing example of a species on the landscape.

Potentially invasive plants - Non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth.

Spatial gaps - This term is used in reference to the ability of a species to disperse away from existing occurrences. The concept of crossing spatial gaps is used to distinguish those species that can disperse over discontinuities and become established elsewhere from species that spread across a habitat only by continual, uninterrupted growth.