Materials for:

Notice of Public Hearing - Massachusetts Prohibited Plant List

Tuesday, July 12, 2022
10 a.m. - 12 p.m.

Document List:

- Non-Native Invasive Plant Work Sheets:
    - Japanese Black Pine (*Pinus thunbergii*)
    - Scotch Broom (*Cytisus scoparius*)
    - Weeping Lovegrass (*Eragrostis curvula*)
- Species Information:
    - Japanese Black Pine (*Pinus thunbergii*)
    - Scotch Broom (*Cytisus scoparius*)
    - Weeping Lovegrass (*Eragrostis curvula*)

SPECIES: *Pinus thunbergii*

STATUS: **INVASIVE**

NON-NATIVE INVASIVE PLANT WORK SHEET

1. Is the taxon nonindigenous to Massachusetts (1)?
   Yes No Haines 2011, Cullina et al. 2011

If yes, go to #2. If no, do not go further.

2. (3 questions) Is the taxon:
   Yes No Have the biological potential for rapid and widespread dispersion and establishment in Minimally managed habitats (2)?

   Comment: This species has the potential to produce many seeds and persist over time in nutrient-poor, sandy habitats.

   Yes No Have the biological potential for dispersing over spatial gaps (3)?

   Comment: This species produces numerous cones that can be moved by wind and water, dispersing seeds away from parent plants to become established elsewhere.

   Yes No Have the biological potential for existing in high numbers away from artificial habitats (4)?

Comment: It is documented in minimally managed habitats including conservation lands throughout the islands of MA.

If Yes to all of these, go to #3. If No to any of these, do not go further.

3. Is the taxon naturalized in Massachusetts (5)?
   Yes No

   Comment: The species has been in Massachusetts for over a century.

If Yes to #3, go on to number #4. If No to #3, go to # 5.

4. (4 questions) Is the taxon:
   Yes No Currently widespread in Massachusetts or at least common in part of the state or habitat type(s) in the state (6)?

Comment: The species is apparently common in southeastern Massachusetts including Cape Cod and Nantucket with some evidence from Martha's Vineyard, however, we do not currently have evidence that it is widespread outside of these areas.

   Yes **No** Known to have numerous individuals in many occurrences in

Massachusetts (7)?

Comment: Where it occurs in sandy soils, this species has large stands of many individuals.

Yes No Out-competing other species in the same natural plant community (8)?

Comment: *P. thunbergii* forms dense stands and high numbers in minimally managed habitats (Bois 2021). It has invaded the globally rare sandplain grasslands and other sites with known rare plant populations primarily on Nantucket.

Yes No Known to have the potential for rapid growth, high seed or propagule production, dissemination, and establishment in natural plant communities in Massachusetts (9)?

Comment: This species is known to have these attributes where it has been documented on Nantucket.

If Yes to all of these 4 questions, the taxon should be considered to be an <u>Invasive Species</u> in Massachusetts. If No to any of these, the taxon can be considered to be a <u>Likely Invasive Species</u> in Massachusetts at this time if it meets at least one of the following 3 criteria.

5. (3 questions)

Yes No Is there at least one naturalized occurrences that has high numbers of individuals forming dense stands in minimally managed habitats (10)?

Comment: There are numerous naturalized occurrences away from areas where originally planted, many in conservation lands that are managed minimally for early successional habitat.

Yes No Does the taxon have the potential, based on its biology and history In the Northeast or elsewhere, to become invasive in Massachusetts (11)?

Comment: In areas where this species is introduced, USDA Plant Hardiness zones 6-8, this species has the ability to reproduce and become invasive, particularly on sandy soils.

Yes No Is the taxon acknowledged to be invasive in nearby states but its current status in Massachusetts unclear (12)?

Comment: *P. thunbergii* is reported as invasive by Delaware. It is on the watch list for Rhode Island.

If yes to question # 1 and all three questions in #2 but no to question #3, the species should be considered a <u>Potentially Invasive Species</u> in Massachusetts at

this time if it meets all three of the following questions.

6. (3 questions) The species…

Yes No Naturalization in Massachusetts is anticipated (13)?

Yes No Has a documented history of invasiveness in the Northeast (14)?

Yes No If naturalized in Massachusetts, poses an imminent threat to the biodiversity of the Commonwealth (15)?

COMMENTS: If this species is "Invasive" in Massachusetts it is only likely to be so in sandy soils in the southeastern part of the state. It does not appear to merit "Invasive" status over much of the rest of the Commonwealth. Much work on documentation has been done on Nantucket Island. More data may need to be collected from other locations within suitable habitat. *P. thunbergii* may be present, but not being documented throughout its current range. If the information on Nantucket alone is not enough to warrant "Invasive", then *P. thunbergii* should be listed as "Likely Invasive".

Evaluation completed by Sarah Bois - Linda Loring Nature Foundation stbois@llnf.org

Voted as **Likely Invasive** by MIPAG, 12-9-21

SPECIES: *Cytisus scoparius*

STATUS: **LIKELY INVASIVE**

NON-NATIVE INVASIVE PLANT WORK SHEET

1. Is the taxon nonindigenous to Massachusetts (1)?
   Yes No Haines 2011, Cullina et al. 2011

If yes, go to #2. If no, do not go further.

2. (3 questions) Is the taxon:
   Yes No Have the biological potential for rapid and widespread dispersion and establishment in Minimally managed habitats (2)?

   Comment: This species has the potential to produce many seeds, spread vegetatively, and persist over time in sandy habitats.

   Yes No Have the biological potential for dispersing over spatial gaps (3)?

   Comment: This species produces fruits and seeds that can disperse by wind and water away from parent plants and become established elsewhere.

   Yes No Have the biological potential for existing in high numbers away from artificial habitats (4)?

Comment: This has been reported from numerous places on Cape Cod. Martha's Vineyard, Nantucket, and the Elizabeth Islands. It is documented in minimally managed habitats including conservation lands.

If Yes to all of these, go to #3. If No to any of these, do not go further.

3. Is the taxon naturalized in Massachusetts (5)?
   Yes No
   Comment: The species has been in Massachusetts for over a century.

If Yes to #3, go on to number #4. If No to #3, go to # 5.

4. (4 questions) Is the taxon:
   Yes **No** Currently widespread in Massachusetts or at least common in part of the state or habitat type(s) in the state (6)?

Comment: The species is apparently common in southeastern Massachusetts including Cape Cod, Nantucket, Martha's Vineyard, and the Elizabeth Island, however, we do not currently have evidence that it is widespread outside of these areas.

   Yes No Known to have numerous individuals in many occurrences in Massachusetts (7)?

Comment: This species is well documented along the south coast of Massachusetts predominantly from Cape Cod and the islands, Plymouth, and around Boston.

Yes No Out-competing other species in the same natural plant community (8)?

Comment: *C. scoparius* forms dense stands and high numbers in minimally managed habitats (Bois 2021). It has invaded the globally rare sandplain grasslands and other sites with known rare plant populations.

Yes No Known to have the potential for rapid growth, high seed or propagule production, dissemination, and establishment in natural plant communities in Massachusetts (9)?

Comment: This species is known to have these attributes in western North American occurrences. On Nantucket, it has been documented that *C. scoparius* spreads rapidly after being mowed and can reproduce and spread seed and vegetatively from parent plants.

If Yes to all of these 4 questions, the taxon should be considered to be an <u>Invasive Species</u> in Massachusetts. If No to any of these, the taxon can be considered to be a <u>Likely Invasive Species</u> in Massachusetts at this time if it meets at least one of the following 3 criteria.

5. (3 questions)

Yes No Is there at least one naturalized occurrence that has high numbers of individuals forming dense stands in minimally managed habitats (10)?

Comment:

Yes No Does the taxon have the potential, based on its biology and history In the Northeast or elsewhere, to become invasive in Massachusetts (11)?

Comment:

Yes No Is the taxon acknowledged to be invasive in nearby states but its current status in Massachusetts unclear (12)?

Comment:

If yes to question # 1 and all three questions in #2 but no to question #3, the species should be considered a <u>Potentially Invasive Species</u> in Massachusetts at this time if it meets all three of the following questions.

6. (3 questions) The species…

Yes No Naturalization in Massachusetts is anticipated (13)?

Yes No Has a documented history of invasiveness in the Northeast (14)?

Yes No If naturalized in Massachusetts, poses an imminent threat to the biodiversity of the Commonwealth (15)?

COMMENTS: This species has had much more documentation, spread, and competition in minimally managed habitats since it was last evaluated. This, as well as potential for further expansion due to changing climate in Massachusetts, supports listing this species as **LIKELY INVASIVE.**

Initial evaluation completed:
Sarah Bois - Linda Loring Nature Foundation stbois@llnf.org

Voted as **Likely Invasive** by MIPAG, 12-9-21

SPECIES: Eragrostis curvula (Schrad.) Nees (Weeping Lovegrass)
syn. *Eragrostis robusta* (Schrad.) Nees; *Eragrostis chloromelas* (Schrad.) Nees; *Eragrostis curvula var. conferta* Steud.

STATUS: **INVASIVE**

NON-NATIVE INVASIVE PLANT WORK SHEET

1. Is the taxon nonindigenous to Massachusetts (1)?

Yes No Haines, 2011.

If yes, go to #2. If no, do not go further.

2. (3 questions) Is the taxon:

Yes No Have the biological potential for rapid and widespread dispersion

and establishment in minimally managed habitats (2)?

Comment: This species has been documented in coastal areas of Massachusetts, Long Island, and other areas with similar climate. It is abundant and widespread along roadsides on Nantucket and has also been documented in minimally managed habitats such as former agricultural grasslands being managed for early successional species and along trails and road edges in sandplain grassland and coastal heathland.

Yes No Have the biological potential for dispersing over spatial gaps (3)?

Comment: *E. curvula* is reported from AL, AR, AZ, CA, CO, DE, FL, GA, HI, KS, KY, LA, MD, MS, NC, NJ, NM, NY, OH, OK, OR, SC, TN, TX, UT, WV and Puerto Rico (Gucker 2009). EDDMapS also lists records for MI, NE, VA, and WA.

Yes No Have the biological potential for existing in high numbers away

from artificial habitats (4)?

Comment: This species has been appearing in locations away from landscape plantings and road edges into minimally managed grasslands and shrublands. A large population expansion occurred at a conservation property with sandplain grassland rare species where it colonized areas away from original plantings and increased from an area of 294 m^2 to an area of over 700 m^2 between 2011 and 2017.

3. Is the taxon naturalized in Massachusetts (5)?

Yes No

Comment:

If Yes to #3, go on to number #4. If No to #3, go to # 5.

4. (4 questions) Is the taxon:

Yes No Currently widespread in Massachusetts or at least common in part of the state or habitat type(s) in the state (6)?

Comment: This species is abundant and widespread on Nantucket, but not common in other parts of the states, although it may easily be overlooked if people are not familiar with its characteristics. It has also been found in these coastal areas of MA: Nantucket, Bristol, Plymouth, Barnstable, and Dukes counties.

Yes No Known to have numerous individuals in many occurrences in Massachusetts (7)?

Comment: High numbers and a wide distribution of this species currently occurs on Nantucket, MA. A number of occurrences of this species have been documented in other areas of the state, but population data is not extensive.

Yes No Out-competing other species in the same natural plant community (8)?

Comment: This species occurs at known rare plant sites and is directly competing with the endangered taxa, particularly sandplain grassland and coastal heathland species.

Yes No Known to have the potential for rapid growth, high seed or propagule production, dissemination, and establishment in natural plant communities in Massachusetts (9)?

Comment: An individual plant can produce hundreds to thousands of seeds, and reproduction may be asexual or sexual; plants successfully self-pollinate. Seed readily establishes on disturbed or burned soils and may be carried by mowers conducting habitat management in conservation areas during the dormant season.

If Yes to all of these 4 questions, the taxon should be considered to be an **Invasive Species** in Massachusetts. If No to any of these, the taxon can be considered to be a Likely Invasive Species in Massachusetts at this time if it meets at least one of the following 3 criteria.

5. (3 questions)

Yes No Is there at least one naturalized occurrences that has high numbers

of individuals forming dense stands in minimally managed habitats (10)?

Comment:

Yes No Does the taxon have the potential, based on its biology and history In the Northeast or elsewhere, to become invasive in Massachusetts (11)?

Comment

Yes No Is the taxon acknowledged to be invasive in nearby states but its current status in Massachusetts unclear (12)?

Comment:

If yes to question # 1 and all three questions in #2 but no to question #3, the species should be considered a Potentially Invasive Species in Massachusetts at this time if it meets all three of the following questions.

6. (3 questions) The species…

Yes No Naturalization in Massachusetts is anticipated (13)?

Yes No Has a documented history of invasiveness in the Northeast (14)?

Yes No If naturalized in Massachusetts, poses an imminent threat to the biodiversity of the Commonwealth (15)?

COMMENTS: The abundance and spread of this species in numerous habitats on Nantucket and other coastal areas and the documentation in other areas of the state merits the listing of **INVASIVE**.

Evaluation completed by Kelly Omand, Nantucket Conservation Foundation 9-7-21

Voted as **Invasive** by MIPAG, 12-9-21

***Pinus thunbergii* Parl. Japanese Black Pine**

Syn. *Pinus thunbergiana* Franco, nom. illeg.

TAXONOMY

Family Pinaceae

Pinus thunbergii is a small evergreen tree that can reach heights of about 6-9 m tall and about 6-11 m wide in cultivation. It can reach the height of 40 m in its natural range. The needles are in fascicles of two with a white sheath at the base, 7–12 cm long; female cones are 4–7 cm in length, scaled, with small points on the tips of the scales, taking two years to mature. Male cones are 1–2 cm long borne in clumps of 12-20 on the tips of the spring growth. Bark is gray on young trees and small branches, changing to black and plated on larger branches and the trunk; becoming quite thick on older trunks (Gilman and Watson 1994).

Sometimes confused with *Pinus nigra* which is also not native to North America. *P. nigra* is found in central Massachusetts on forest edges and scrub thickets. *P. nigra's* growth form is relatively uniform with an unbranched main stem whereas *P. thunbergii* has irregular growth habit and forked main stem and branches (Haines 2011).

NATIVE REGION OR RANGE

P. thunbergii is native to northeastern China and coastal areas of Korea and Japan. *P. thunbergii* prefers full sun and can tolerate a wide range of soil types. It is tolerant to both drought and high salinity. It can be found in anthropogenic, forest edges, shrublands or thickets. The pinewood nematode, *Bursaphelenchus xylophilus*, was accidentally introduced to Japan (native to North America) and is threatening the *P. thunbergii* in its native range.

HISTORY

P. thunbergii was introduced to the US from Japan in 1855. It was planted in some coastal areas for its salt tolerance and tolerance to dry, sandy conditions. It was used for stabilizing soil, providing a wind break, and for its fast-growing properties.

In Massachusetts, *P. thunbergii* was first planted on Nantucket, Martha's Vineyard, and Cape Cod in the late 1800's for a combination of its fast growth and its dune stabilizing capabilities. It is well-adapted to dry, sandy soils and grows well in full sunlight; ideal conditions for these coastal communities.

BIOLOGY

Life Form – evergreen tree

Naturalized - YES

Dispersal – wind, animals, gravity

Massachusetts habitats – Anthropogenic (man-made or disturbed), forest edges, shrublands or thickets. Coastal dune communities. *Pinus thunbergii* stands of the northeastern coastal region occurs on well-drained to xeric sandy soils, usually on sand dunes or near-coastal glacial tills.

Biological potential – *P. thunbergii* occurs in coastal sites, disturbed sites, sand dunes, and dry scrubland. It grows well in full sun. On Nantucket specifically, it is seen as an ecological threat to native grasslands of Massachusetts and the globally rare sandplain grasslands of coastal Massachusetts and the islands.

In North America *P. thunbergii* is subject to mortality by the native pinewood nematode, *Bursaphelenchus xylophilus*, spread by means of beetle vectors; primarily turpentine beetle, *Dendroctonus terebrans*. Subsequently, blue stain fungus, *Leptographium* sp., invades the plant, leading to a rapid decline and death. Standing dead become fire hazards and hazards for human health.

REPORTED INVASIVENESS

P. thunbergii is reported as **invasive** by Delaware. It is on the watch list for Rhode Island. There are EDDMapS records of *P. thunbergii* from 5 states – MA, RI, DE, MD, and NY (EDDMapS 2021).

According to Natureserve, *P. thunbergii* plantations occur on Cape Cod National Seashore and Boston Harbor Islands National Recreation Area, Massachusetts; Block Island, Rhode Island; and Fire Island National Seashore and Gateway National Recreation Area, New York.

P. thunbergii has been designated as a highly invasive, non-native species on Nantucket by the Invasive Plant Species Committee of the Nantucket Biodiversity Initiative, a consortium scientists, landscapers, and concerned citizens that conduct collaborative invasive species removal projects and public education efforts on the island. It was added to the Town of Nantucket's Conservation Commission list of invasive plants as Highly Invasive (https://www.nantucket-ma.gov/DocumentCenter/View/1008/Conservation-Commission-Wetland-Regulations-2013-PDF).

In Rhode Island, *P. thunbergii* was frequently planted on Block Island for wind breaks and dune stabilization. It was noted to be naturalized and spreading in RI by at least the 1990's if not earlier.

P. thunbergii is found all along Suffolk County on Long Island, NY. This county is climatically similar to coastal Massachusetts particularly the south coast and islands.

DISTRIBUTION

Massachusetts Counties

	BE	FR	HS	HD	WO	MI	ES	SU	NO	BR	PL	BA	DU	NA
			X				X					X	X	X

USDA Plants database reports this taxon in Massachusetts

EDDMapS. 2021

iNaturalist 2021

Additionally, Mike Whittemore, The Nature Conservancy, reported *Pinus thunbergii* from a species list for their Bamford property on Martha's Vineyard.

SPREAD & IMPACTS

In addition to Massachusetts *P. thunbergii* is reported from SC, NC, TN, VA, OH, MD, NJ, NY, CT, DE, and RI on the eastern US (USDA 2021, EDDMapS 2021).

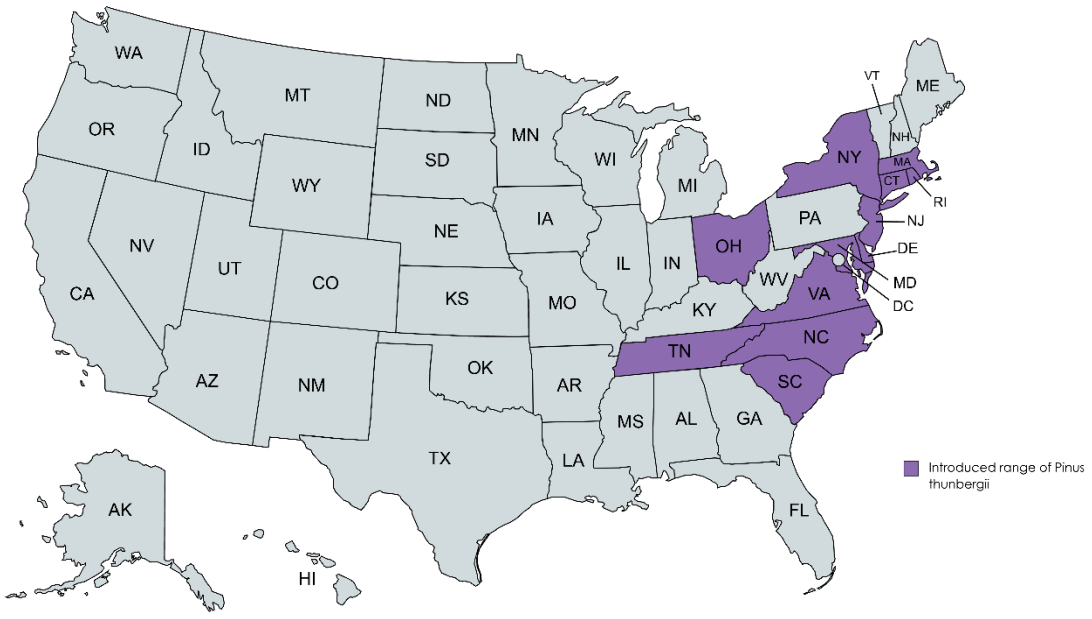

Figure 1: Introduced range of *Pinus thunbergii* in U.S. (based on EDDMapS, iNaturalist, and USDA data).

As of 8/17/21, EDDMapS lists 58 observations from Massachusetts predominantly from Cape Cod and Nantucket. It is important to note that in EDDMapS, one observation point can represent multiple individual plants or an area. On Nantucket alone, the 58 points represent at least 500 trees. These records were predominantly found in minimally managed habitats – conservation lands, town-owned open spaces, bike paths, and road edges (Bois 2021).

For the past 10 years in Delaware, *P. thunbergii* trees were actively removed due to impeded native vegetation. Post World War 2, over 50,000 *P. thunbergii* trees were planted along the Delaware coast and spread from those initial plantings. Now the trees are being removed in a decades-long project at Cape Henlopen State Park among others (according to local news reports in Delaware: https://www.capegazette.com/article/state-rids-parks-japanese-black-pines-make-room-native-species/6810).

In 2009, Rob Line, head of Delaware's Environmental Stewardship program for the Division of Parks, said aerial surveys show Japanese black pines dominated 30 percent to 40 percent of Delaware's coastline.

At the Linda Loring Nature Foundation on Nantucket, the land trust has been working to remove invading *P. thunbergii*. Since 2018 they have cleared approximately 12 acres of *P. thunbergii*, but the effective area, the area that will benefit from the treatment, is estimated to be over 50+ acres as natural ecosystem processes are reinstated (Bois 2021). Some of this work was funded with a Massachusetts State Wildlife Habitat Management Grant.

The Nantucket Conservation Foundation, the largest land owner on Nantucket Island, has been managing stands of *P. thunbergii* at several properties across the island. Sandplain grassland and heathland habitats occur immediately adjacent to the project areas, and representative species of these habitat types are present in the understory. Removal of the *P. thunbergii* was done to prevent further the spread and establishment of non-native, invasive pines into the surrounding rare sandplain grassland and heathland habitats and reduce the risk of standing dead trees creating a wildfire hazard.

This species is still sold and planted in the horticultural trade. It is utilized in coastal areas and seashore plantings, reclaiming dunes, and for erosion control/wind breaks. Of concern is that this species is found within and on the edges of sandplain grasslands and coastal dune communities where several globally rare endangered plants are found.

On Nantucket where this species is being targeted for documentation of *P. thunbergii*, there has been an increase in population sightings in natural areas, conservation lands and other open space. *P. thunbergii* is found across the whole of Nantucket Island from east to west, north and south with the largest populations present on the western end of the island. These stands started from plantings in the early 1900's and have spread from there in the last 100 years. Since they were planted at wind breaks, they have been effective at reducing the natural ecological processes that helped shape the island flora, namely salt spray and winds. Removing these trees helps restore these regimes and reclaim the sandplain grassland and heathland plant communities.

P. thunbergii stand before (a) and after (b) management on Nantucket. Post management you can see the grassland and heathland habitat that was restored after the removal of the *P. thunbergii* stand. The stumps of the trees are still visible.

P. thunbergii stand (some standing dead, some live) on Nantucket.

REFERENCES:

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Information compiled by Kelly Omand, Nantucket Conservation Foundation, 2021

***Cytisus scoparius* (L.) Link Scotch Broom**

Syn. *Spartium scoparium* L.

TAXONOMY

Family Fabaceae

Cytisus scoparius is a leguminous shrub that grows 1-2 meters high and is deciduous. Individual plants generally live for approximately 20 years. The stems are five-angled and young stems remain green all year (Hitchcock and Cronquist 1973). The leaves are trifoliolate with petioles 2-10 mm long. The leaflets are obovate to oblanceolate, entire and 6-12 mm long.

The yellow flowers of *C. scoparius* are usually borne solitary in axils, blooming between May and June. Petals are about 2 cm long. The flaring calyx is glabrous, about 7 mm long and is two lipped with short teeth. The brownish black pods, 3.5 to 5 cm long, are villous on the margins only. These pods are compressed, several seeded, with a callous appendage near the base (Munz and Keck 1973).

There are a number of horticultural cultivars currently being sold. These are still *C. scoparius*, but flower colorations may vary from light yellow, almost white to reddish and pink.

NATIVE REGION OR RANGE

Native to North Africa, the British Isles and central and southern Europe, *C. scoparius* is well adapted to dry sandy soils and grows well in full sunlight. Throughout its native range it is somewhat invasive especially in neglected areas and is known to encroach into poorer pastures. It can also be found along roadsides, coastal sites, disturbed sites, pastures and dry scrubland.

HISTORY

C. scoparius has been introduced to many parts of the world as an ornamental (e.g. Canada, Chile, India, Iran, Australia, New Zealand, South Africa, and the United States). In North America, *C. scoparius* was introduced to Virginia in the early 1800s for use as fodder for domestic sheep. It was considered invasive in that area by 1860. *C. scoparius* was introduced to California as an ornamental in the 1850s, was widely used for roadside erosion control in the early 1900s, and was recognized as a problem in California by the 1930s. It was introduced to Vancouver Island in 1850 as an ornamental; and from 3 surviving plants, it spread over most of Vancouver Island over the next century and a half. After multiple purposeful introductions *C. scoparius* was recognized as a problem in many western US states by the late 1800's (Zouhar 2005).

In Massachusetts, *C. scoparius* was first planted on Nantucket, Martha's Vineyard, and Cape Cod in the late 1800's for a combination of its appearance and its dune stabilizing capabilities. It is well-adapted to dry, sandy soils and grows well in full sunlight; ideal conditions for these coastal communities.

BIOLOGY

Life Form – large shrub

Naturalized - YES

Dispersal – ballistic and wind

Massachusetts habitats – Anthropogenic (man-made or disturbed), coastal beaches (sea beaches), dunes, coastal grasslands

Biological potential – *Cytisus scoparius* occurs along roadsides, coastal sites, disturbed sites, pastures, and dry scrubland. Its nitrogen fixing ability allows it to compete successfully on nutrient-poor, dry, sandy soils. It grows well in full sun. It is seen as an ecological threat to native grasslands of Massachusetts and the globally rare sandplain grasslands of coastal Massachusetts and the islands. *C. scoparius* can photosynthesize all year long with its evergreen stems. It is leafless from fall to early spring, allowing light to reach seedlings and younger plants giving it a competitive advantage over other deciduous vegetation.

C. scoparius can reproduce vegetatively or via seed. *C. scoparius* bushes can produce up to 60 seed pods per bush by their second year. Adult plants can produce hundreds of seed pods. Each pod usually contains 5-8 seeds (Waloff and Richards 1977). Scotch Broom reproduces almost exclusively by seed which are dispersed balistically. The seeds are known to be viable in the seedbank for up to 30 years (Bossard 2000). *C. scoparius* is known to have a deep root system with a forked taproot allowing it to persist in dry conditions.

REPORTED INVASIVENESS

C. scoparius is regarded as a noxious weed throughout much of its introduced range, especially in western North America. It is reported as **invasive** by 12 states (AK, OR, CA, ID, MT, WA, WI, UT, SC, CO, HI, and MD). It is on the watch list for New Hampshire. There are records of *C. scoparius* for 31 states (EDDMapS 2021, USDA 2021).

The Town of Nantucket's Conservation Commission list of invasive plants currently lists *C. scoparius* as Potentially Invasive.

C. scoparius can spread quickly because its seeds disperse explosively and are carried along by wind. Ballistic dispersal of seeds resulted in a mean dispersal distance of 3 feet (96 cm), a median distance of 44 inches (112.8 cm), and a maximum distance of 213 inches (540 cm) in a California study (Bossard 1991).

This species is considered invasive in New Zealand and Australia.

C. scoparius is considered one of the worst invasives in the Pacific Northwest. Naturalized populations often form dense thickets and, as a result, the weed is regarded as a noxious pest in forests and natural areas throughout the region. *C. scoparius* displaces native and important forage species as well as complicates restoration efforts. It readily invades disturbed sites, natural areas, dunes, and forestlands. Broom control costs are in the millions of dollars each year due to its rapid growth, seed bank, and persistent nature ($47 million annually, Coombs et al. 2004). In addition to financial costs, Scotch Broom has a history of invading and replacing native grasslands. There is evidence from Washington State where stands of *C. scoparius* are replacing native prairie communities. At The Nature Conservancy preserves in Washington State, *C. scoparius* occurs in lowland prairies where it displaces native species and may impact threatened species.

C. scoparius is highly flammable and can increase fire intensity. Mature plants can sprout from the root crown after a disturbance (i.e. fire or cutting) that injures or kills above-ground stems. Seed germination is high following disturbances that expose mineral soil. Although fire can reduce the seed bank by up to 80% (Downey 2000), seeds that remain are usually sufficient to regenerate a stand. Biocontrol agents are also being evaluated to control Scotch broom (Bossard & Rejmanek 1994).

DISTRIBUTION

Massachusetts Counties

	BE	FR	HS	HD	WO	MI	ES	SU	NO	BR	PL	BA	DU	NA
			X						X	X	X	X	X	X

USDA Plants database reports this taxon in Massachusetts

EDDMapS. 2021

iNaturalist 2021

SPREAD & IMPACTS

In addition to Massachusetts *C. scoparius* is reported from AL, GA, SC, NC, TN, VA, WVA, PA, OH, MI, MD, NJ, NY, CT, DE, NH, and ME on the eastern US as well as Nova Scotia (USDA 2021). It is also reported in western states (MT, ID, AK, HI, WA, OR, CA, UT, and B.C.). Haines 2011 lists it additionally from Rhode Island. iNaturalist has verified records from Texas, Colorado, Kansas, and Nevada.

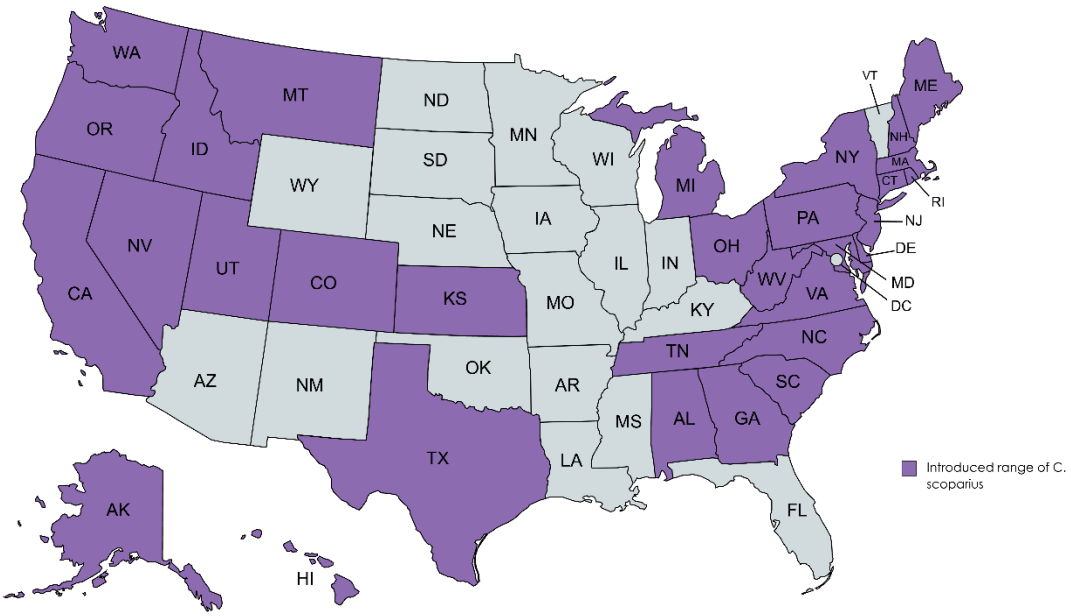

Figure 1: Introduced range of *C. scoparius* in U.S. (based on EDDMapS, iNaturalist, and USDA data).

As of 8/17/21, iNaturalist lists 131 observations from Massachusetts predominantly from Cape Cod and the island, Plymouth, and around Boston. EDDMapS 2021 has 213 observations in Massachusetts 159 of which are form the concentrated efforts on Nantucket Island. It is important to note that in EDDMapS, one point can represent multiple individual plants. On Nantucket alone, the 159 points represent at least 420 plants. These records were predominantly found in minimally managed habitats – conservation lands, town-owned open spaces, bike paths, and road edges (Bois 2021).

Historically, *C. scoparius* does not do well in New England winters with seedlings and young plants being especially sensitive to frost. Massachusetts is now approximately 2°C warmer than previous long-term averages (NOAA 2019). With warmer winters and earlier spring temperatures, global climate change may make Massachusetts a more suitable climate for *C. scoparius* to persist over the winter and spread further in maritime habitats.

This species is capable of producing large amounts of ballistic and wind dispersed seeds and jumping large spatial gaps. It is also still widely sold and planted in the horticultural trade. Of concern is that this species is found within and on the edges of sandplain grasslands where several globally rare endangered plants are found.

In recent decades there have been anecdotal observations of an increase in *C. scoparius* populations on the Cape and Islands of Massachusetts. On Nantucket where this species is being targeted for documentation, there has been an increase in population sightings in natural areas, along roadsides, and bike paths (Bois 2021). This plant is currently seen at the edges of sandplain grasslands which are akin to prairie landscapes on the western states; a habitat *C. scoparius* is known to invade.

C. scoparius was previously evaluated by MIPAG in 2004. At that time, it was only listed as invasive in western states. Les Mehrhoff determined that there wasn't evidence of invasiveness in Massachusetts despite being prevalent along the southeast coast. He recommended at the time that experts familiar with these habitats be consulted. Since that time, many additional records have been added and additional states have added *C. scoparius* to their invasive of watch lists.

C. scoparius in minimally managed habitats.

C. scoparius dispersing seeds along a minimally managed road edge along conservation land.

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Information compiled by Sarah Bois, Linda Loring Nature Foundation, 2021

***Eragrostis curvula* (Schrad.) Nees (Weeping Lovegrass)**

TAXONOMY

Family Poaceae

Weeping lovegrass *(Eragrostis curvula)* was introduced from Africa as an ornamental in southern New England and has been found to spread rapidly in sandy acidic soils. Reported on Barnstable County, Cape Cod in Massachusetts according to BONAP data (GoBotany, Haines 2011). Weeping lovegrass was described in *The Vascular and Non-Vascular Flora of Nantucket, Tuckernuck, and Muskeget (1996)* on Nantucket as "rare in waste areas, first recorded in 1985." Since that time, this grass has been widely planted as an ornamental in gardens and seeded as erosion control on Nantucket. Also, this grass has been observed appearing without cultivation from seed dispersed along roadsides and in natural areas, including globally rare sandplain grassland and coastal heathland habitats on Nantucket (Bois and Omand, pers. obs.). The foliage is arching or weeping and arises from dense clumps that quickly colonize bare soil via seed that is produced amply on large panicles. Tolerant of disturbance, salt spray, and dry, sandy, low-nutrient acidic soils, this species has been used for erosion control and as an ornamental xeriscape element in coastal areas of MA and on Long Island. It greens up 2-4 weeks earlier than native warm season grasses, creating a tall dense cover that allows it to aggressively compete against native grasses and forbs, forming dense cover and able to exclude even taller native grasses and forb species such as little bluestem, switchgrass, or goldenrod.

Synonymy: *Eragrostis robusta* (Schrad.) Nees; *Eragrostis chloromelas* (Schrad.) Nees; *Eragrostis curvula var. conferta* Steud.

NATIVE REGION OR RANGE

Eragrostis curvula is a species of warm season grass native to southern Africa, commonly called weeping lovegrass and Boer lovegrass (Figure 1).

Figure 1: Map of native range of weeping lovegrass *(Eragrostis curvula).*

HISTORY

In the U.S., *Eragrosis curvula* was first vouchered in Oklahoma in 1935, where two million acres were seeded (Gucker 2009). By the 1960s, it was found in New York State, where it was extensively planted along expressways for erosion control. Other major plantings occurred in the Southwest on rangelands and areas with erosion problems and mine spoils (Gucker 2009). Genotypes from different parts of Africa were introduced in the U.S. and described as cultivars (Gucker 2009).

Since introduction *E. curvula* has become established in at least 32 U.S. states, in areas as far north as Ohio and Illinois (Cronquist et al. 1977).

BIOLOGY

Life Form: perennial warm season bunchgrass.

Naturalized: Yes.

Dispersal: apomictic (asexual seed production) and able to self-pollinate sexually, producing copious seeds. Seeds are dispersed by wind, late summer or fall mowing, brush cutting, and disposal of landscape waste. Seeds may be carried by runoff and wind (Gucker 2009, Roberts et al. 2021).

Massachusetts habitats -- Road edges, agricultural grasslands, sandplain grassland, and coastal heathland areas have been colonized, mainly in coastal and island counties. In globally rare early successional habitats, this grass has demonstrated the ability to expand rapidly with the potential to crowd out several rare plant species. Since 2013, conservation landowners on Nantucket have been pre-emptively removing small patches that appear in conservation areas, which has likely minimized the expansion of this species in native, minimally managed habitats.

Biological potential -- High seed production and seed banking in litter layer allow fast spread once introduced (Roberts et al. 2021). On Nantucket, patches have appeared in natural areas receiving only annual mowing or fire management, isolated from landscaped areas. Colonization typically begins along trails and roadsides, but areas of cover expanded in a few years into established grassland or low shrubland and may be exacerbated by mowing management during the dormant season.

Weeping lovegrass has been observed naturalized on Nantucket, Martha's Vineyard, and Cape Cod. Cold tolerant as far north as MI, OH and IL, so there is potential for spread where introduced elsewhere in New England and spread may be exacerbated by warming climate in the future, as it expands from coastal areas. Weeping lovegrass is salt and drought tolerant with

a wide pH range; it is fire tolerant (adult plants and seed survival in litter layer) and may increase with burning (Gucker 2009). Plants are cold tolerant when there is a lot of aboveground material to insulate the crown during the winter, allowing them to survive temperatures of -16˚F to -20˚F in MD and NY (Gucker 2009).

REPORTED INVASIVENESS

Weeping lovegrass is included on the Mid-Atlantic Exotic Pest Plant Council Plant List which states that the species has been reported as invasive in: AZ, MD, NC, NJ, TN, TX, UT, and VA [Mid Atlantic]. While not listed as an invasive in any New England state, weeping lovegrass is on the "Research List" for CT [CIPWG]. New Jersey is the nearest state to Massachusetts that recognizes weeping lovegrass as invasive, placing it on their "Do Not Plant" list [New Jersey] and describing this species as "Emerging Stage 2 – Uncommon (may be regionally common or abundant)" and ranking it as *highly threatening* to native communities [New Jersey].

EDDMapS records indicate that weeping lovegrass is being reported as an invasive from states in the southern tier of the country, as well as the Mid-Atlantic and into the coastal plain of New York and southern New England [EDDMapS]. The highest densities of records are from NC (655), AZ (324), TX (94), VA (71), and NM (61) [EDDMapS]. Coastal areas of MA are described as USDA Climate zone 7a (0 to 5 °F/-17.8 to -15 °C) and 7b (5 to 10 °F/-15 to -12.2 °C) [USDA Climate Map]. These climate zones are well represented in the coastal areas of the Mid-Atlantic region and across the southern tier of the United States, including many states where weeping lovegrass is frequently reported as naturalized or invasive. Climate in Massachusetts is predicted to shift dramatically to match states as far south as NJ-MD (lower emissions scenario) to South Carolina (higher emissions scenario) by the end of the century [UMass State of the Climate Report] (Figure 2). This shift in climate conditions is likely to make weeping lovegrass more able to survive and colonize away from coastal areas.

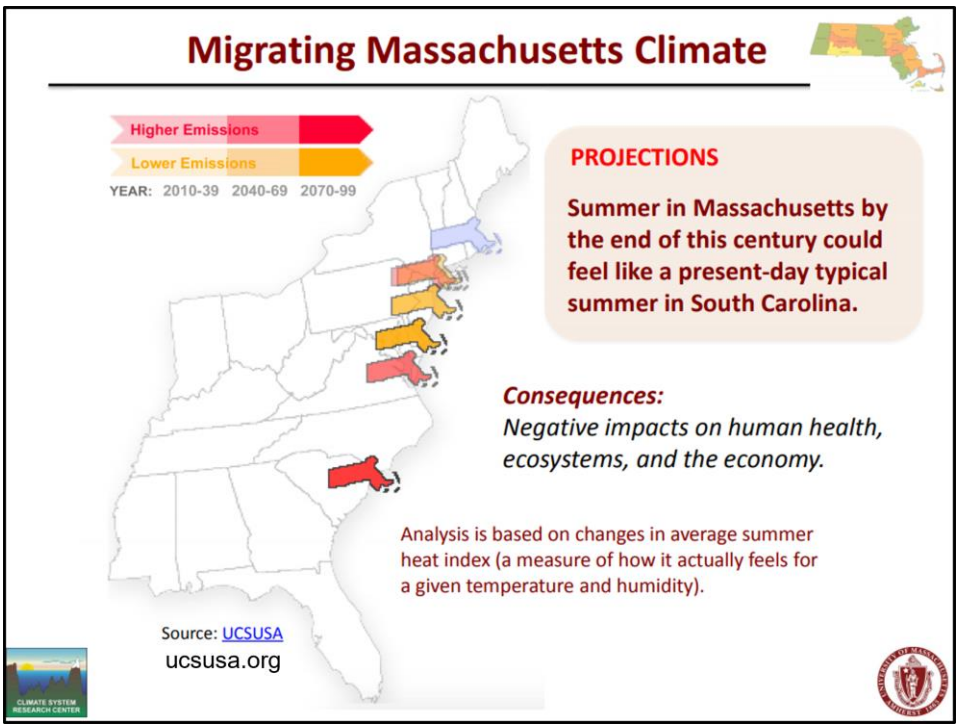

Figure 2: Projected climate shift for Massachusetts under higher and lower emissions scenarios [UMass State of the Climate Report].

The Town of Nantucket included weeping lovegrass as a "Likely Invasive" in 2013 in the Town Wetland Regulations [TON]. One of the factors in this decision was a case where weeping lovegrass expanded from a small ornamental planting at a conservation property, with an initial area of 293 m^2 of cover when first noted in 2011, that increased an additional 410 m^2 between 2012 and 2017. It spread rapidly via seed into grassland areas being managed for early successional species from a dirt driveway edge where some disturbance had occurred. These areas were being managed with grazing and annual mowing at the time and quickly became dominated by weeping lovegrass cover with many small satellite patches popping up in random locations farther away from the driveway. State listed rare species nearby at that site are sandplain blue-eyed grass *(Sisyrinchium fuscatum)* and New England blazing star *(Liatris novae-angliae)*, Special Concern in MA, and St. Andrew's cross *(Hypericum stragulum)*, listed as Endangered in MA. Treatment of lovegrass was initiated quickly, and the population has been reduced to a handful of spot locations and is dominated by native species in 2021.

DISTRIBUTION

Massachusetts Counties

	BE	FR	HS	HD	WO	MI	ES	SU	NO	BR	PL	BA	DU	NA
										X	X	X	X	X

USDA Plants database reports this taxon in Massachusetts, as do iNaturalist (Bristol, 1 record) and EDDMapS (Nantucket, 14 records; Barnstable, 2 records; Plymouth, 1 record). Cullina et a1. (2013) report *E. curvula* as introduced in Plymouth and Barnstable.

SPREAD & IMPACTS

In addition to Massachusetts, *E. curvula* is reported from AL, AR, AZ, CA, CO, DE, FL, GA, HI, KS, KY, LA, MD, MS, NC, NJ, NM, NY, OH, OK, OR, SC, TN, TX, UT, WV and Puerto Rico (Gucker 2009). EDDMapS also lists records for MI, NE, VA, and WA (Figure 3).

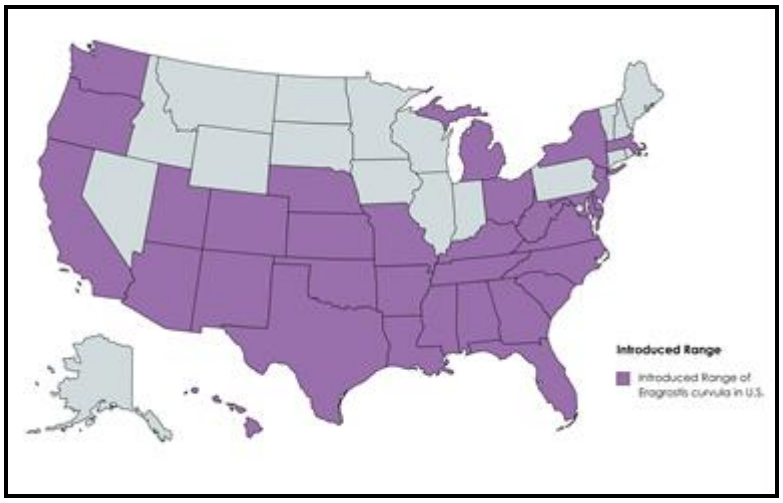

Figure 3: Introduced range of weeping lovegrass in U.S. (based on EDDMapS, iNaturalist, and USDA data).

As grasses are harder to identify, this species may be expanding "under the radar" in some areas and may be more widespread than current documentation indicates.

During a recent tour of three cranberry bogs in Mattapoisett, Rochester, and Freetown, MA in November of 2020 to assess potential for restoring native grasslands in uplands around bogs being retired from cranberry production, we observed this weeping lovegrass growing in the grassy upland areas of every bog, along with a mix of native and non-native grasses and forbs (Omand, pers obs).

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