



Maryland Department
of Agriculture

November 30, 2015

Version 2

Weed Risk Assessment for *Cytisus scoparius* (L.) Link (Fabaceae) – Scotch broom



Top left and right: single blossom and seed pods (source: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org). Bottom left: angled stems (source: Robert Vidéki, Doronicum Kft., Bugwood.org). Bottom right bottom: Blooms and hillside covered in Scotch broom (source: Eric Coombs, Oregon Department of Agriculture, Bugwood.org)

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Introduction The Maryland Department of Agriculture regulates terrestrial ornamental invasive plants under the authority of [Md. AGRICULTURE Code Ann. § 9.5-101](#) et seq. Invasive Plant Prevention and Control. An invasive plant is defined as “a terrestrial plant species that a) did not evolve in the State, and b) if introduced within the State, will cause or is likely to cause, as determined by the Secretary: economic harm; ecological harm; environmental harm; or harm to human health.”

Maryland’s Invasive Plant Advisory Committee (IPAC) was established by legislative mandate in October 2011. The IPAC’s primary responsibility is to advise the Secretary of Agriculture on regulating the sale of invasive plants, and on preventing them from entering Maryland or from spreading further in the state. IPAC evaluates the risk potential of plants already present in Maryland, newly detected in the Maryland or the United States, those proposed for import, and those emerging as weeds elsewhere in the world.

The IPAC evaluates the potential invasiveness of plants using the weed risk assessment (WRA) process developed by the Plant Protection and Quarantine (PPQ) Program of the US Department of Agriculture’s Animal and Plant Health Inspection Service (Koop et al. 2012). PPQ’s risk model uses information about a species’ biological traits and behavior to evaluate its risk potential (Koop et al. 2012).

Because the PPQ WRA model is geographically and climatically neutral, it can be used to evaluate the baseline invasive/weed potential of any plant species for the entire United States, or for any specific region in the United States. In the PPQ process, the geographic potential of the species is evaluated separately so that risk managers can make decisions appropriate for their regions. With respect to Maryland’s evaluation process, we use PPQ’s Geographic Information System overlays of climate to evaluate the potential for a plant to establish and grow in Maryland. The PPQ weed risk assessment also uses a stochastic simulation to evaluate how the uncertainty associated with the assessments affects the model’s predictions. Detailed information on the PPQ WRA process is available in the document, *Guidelines for the USDA-APHIS-PPQ Weed Risk Assessment Process* (APHIS PPQ 2015), which is available upon request.

The IPAC uses a second tool, the Maryland Filter, to assign plant species that score as highly invasive either Tier 1 or Tier 2 status. Maryland regulations define Tier 1 plants as “invasive plant species that cause or are likely to cause severe harm within the State” and Tier 2 plants as “invasive plant species that cause or are likely to cause substantial negative impact within the State.” The Maryland Filter considers the actual and potential distribution of a species in Maryland, its threat to threatened and endangered ecosystems and species in the state, the difficulty of control of the species, and whether added propagule pressure would be likely to increase its persistence and spread significantly. The IPAC then recommends regulations to reduce the risk of the Tiered invasive plants in Maryland.

***Cytisus scoparius* (L.) Link – Scotch broom**

- Species** Family: Fabaceae
- Information** Synonyms: *Cytisus scoparius* (L.) Link, *Genista scoparia* (L.) Lam., *Sarothamnus scoparius* (L.) Wimmer ex W. Koch, *Spartium scoparium* L., *Cytisus scoparius* subsp. *andreasianus*, *Cytisus scoparius* var. *prostratus*, *Cytisus scoparius* f. *sulphureus* (ARS, 2015).
- Common names: Scotch broom, Scottish broom, Irish broom, English broom, European broom, broom, common broom, broomtops (ARS 2015).
- Botanical description: Scotch broom is a shrub that grows 3 - 10 feet tall with green, angled stems and tiny green leaves. Bright yellow, pea-like flowers bloom in spring followed by brown to black seed pods with hairy margins (Rhoads and Block 2007). For a full botanical description see (Rhoads and Block 2007).
- Initiation: This plant is listed on the MD Department of Natural Resources (DNR) Do Not Plant List, a policy document available from MD DNR, which lists approximately 90 plant species that may not be planted on DNR land or used in DNR projects (MD DNR 2010).
- Foreign distribution: This species is native to Europe and North Africa. It is naturalized in Australia, New Zealand, South Africa, parts of Asia, and in British Columbia, Canada (ARS 2015).
- U.S. distribution and status: The largest infestations are found in the Pacific Northwest and California, however it has also naturalized from Maine to Alabama in scattered locations (BONAP 2015; EDDMapS 2015). Scotch broom is regulated in California, Washington, Idaho, Oregon, Hawaii (USDA PLANTS 2015) and in Wisconsin (Wisconsin DNR 2015) and Montana (Montana Department of Agriculture 2015). Scotch broom is widely sold in the nursery trade, e.g. Lowes.com, ebay.com.
- WRA area¹: Entire United States, including territories.
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Summary Statement

Cytisus scoparius received a score of High Risk under the PPQ WRA model because of its high establishment potential across a wide geographic range and its numerous environmental impacts on habitats and ecosystems. The species received a ranking of Tier 2 in the Maryland Filter because its impacts on Maryland threatened species and communities are unknown and it has been naturalized in Maryland since at least the 1950s.

1. *Cytisus scoparius* analysis

Establishment Scotch broom has already demonstrated its ability to establish and spread in multiple

¹ “WRA area” is the area in relation to which the weed risk assessment is conducted [definition modified from that for “PRA area”] (IPPC 2012).

Spread Potential / countries and in numerous U.S. states (Bossard 2015; Weber 2003; Randall 2012). It forms dense stands (CRC Weed Management 2008; Zouhar 2005). One medium-sized shrub can produce over 12,000 seeds a year (Bossard 2014). Seeds are dispersed along rivers during floods (Waterson and Jones 2006) and by ants (Zouhar 2005). Animals occasionally disperse seeds (Zouhar 2005). We had high uncertainty about bird dispersal (DiTomaso 1998). Seeds persist in the seed bank from 5 to 30 years (Bossard 2015). Plants resprout when cut (Bossard 2015) and seeds germinate after fire (CRC Weed Management 2008; Downing and Smith 2000).
Risk score = 40 Uncertainty index = 0.11

Impact Potential Scotch broom transforms ecosystems by increasing fire frequency and intensity, fixing nitrogen, and acidifying soils (Bossard 2015). It forms dense stands in grasslands and lowland prairies (Zouhar 2005), and shades out understory plants and tree seedlings (Weeds of Australia 2015; Downing and Smith 2000). It affects threatened and endangered species and globally outstanding ecoregions (Bossard 2015; Zouhar 2005). Scotch broom is considered a weed in some forest production systems (CABI 2015). Seeds are toxic to some ungulates and horses (Bossard 2015). We had moderate uncertainty about Scotch broom's impact in anthropogenic systems. It is reported as a weed in gardens (Dave's Garden 2015) and it changes park vistas (CABI 2015).
Risk score = 4.4 Uncertainty index = 0.04

Geographic Potential Based on three climatic variables, we estimate that about 72 percent of the United States is suitable for the establishment of *Cytisus scoparius* (Fig. 1). This predicted distribution is based on the species' known distribution elsewhere in the world and includes point-referenced localities and areas of occurrence. The map for *Cytisus scoparius* represents the joint distribution of Plant Hardiness Zones 5-12, areas with 10 to more than 100 inches of annual precipitation, and the following Köppen-Geiger climate classes: Steppe, Desert, Mediterranean, Humid subtropical, Marine west coast, Humid continental warm summers, Humid continental cool summers, Subarctic, and Tundra.

The area of the United States shown to be climatically suitable (Fig. 1) is likely overestimated since our analysis considered only three climatic variables. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. Scotch broom grows across a wide range of habitats from sand dunes to forest edges and floodplains. It grows on a wide range of soil types although it does not grow well in soils high in calcium (CABI 2015).

Entry Potential We did not assess the entry potential of *Cytisus scoparius* because it is already present in the United States (USDA PLANTS 2015).

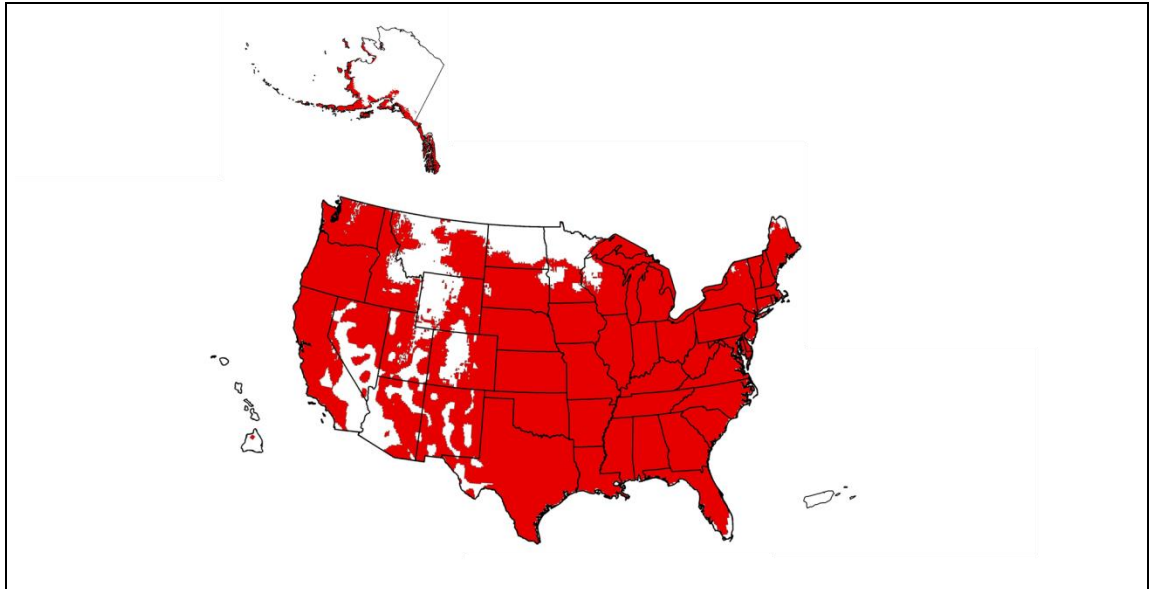


Figure 1. Predicted distribution of *Cytisus scoparius* in the United States. Map insets for Alaska, Hawaii, and Puerto Rico are not to scale.

2. Results

Model Probabilities:

P(Major Invader) = 96.2%

P(Minor Invader) = 3.7%

P(Non-Invader) = 0.1%

Risk Result = High Risk

Secondary Screening = Not applicable

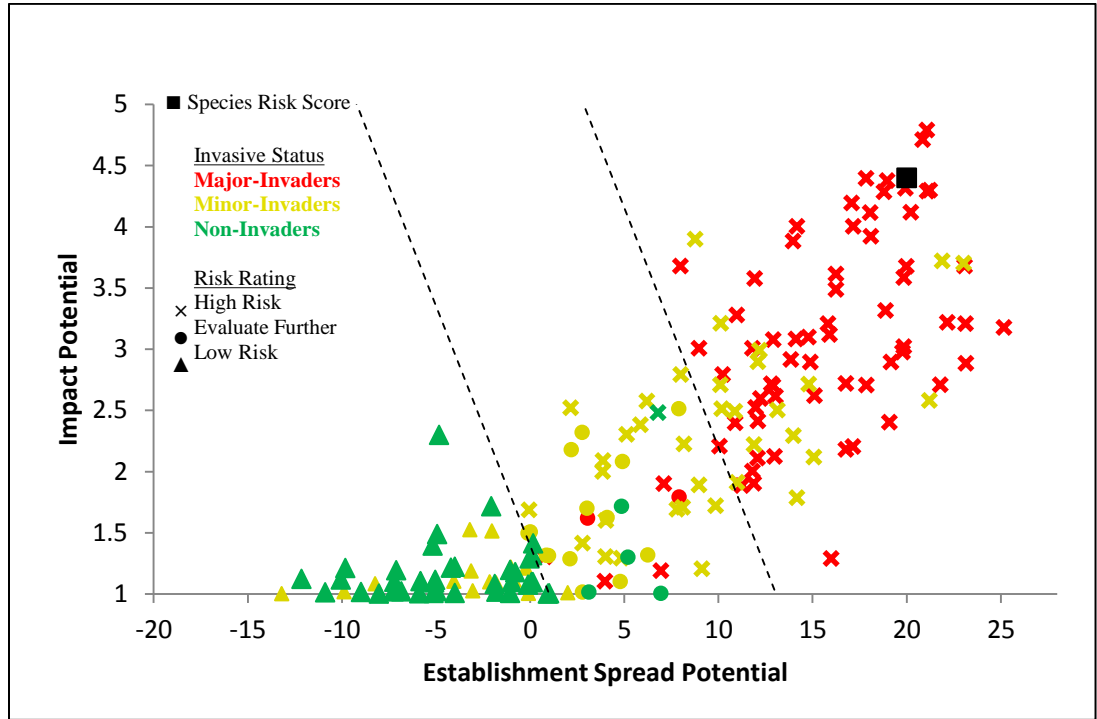


Figure 2. *Cytisus scoparius* risk score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

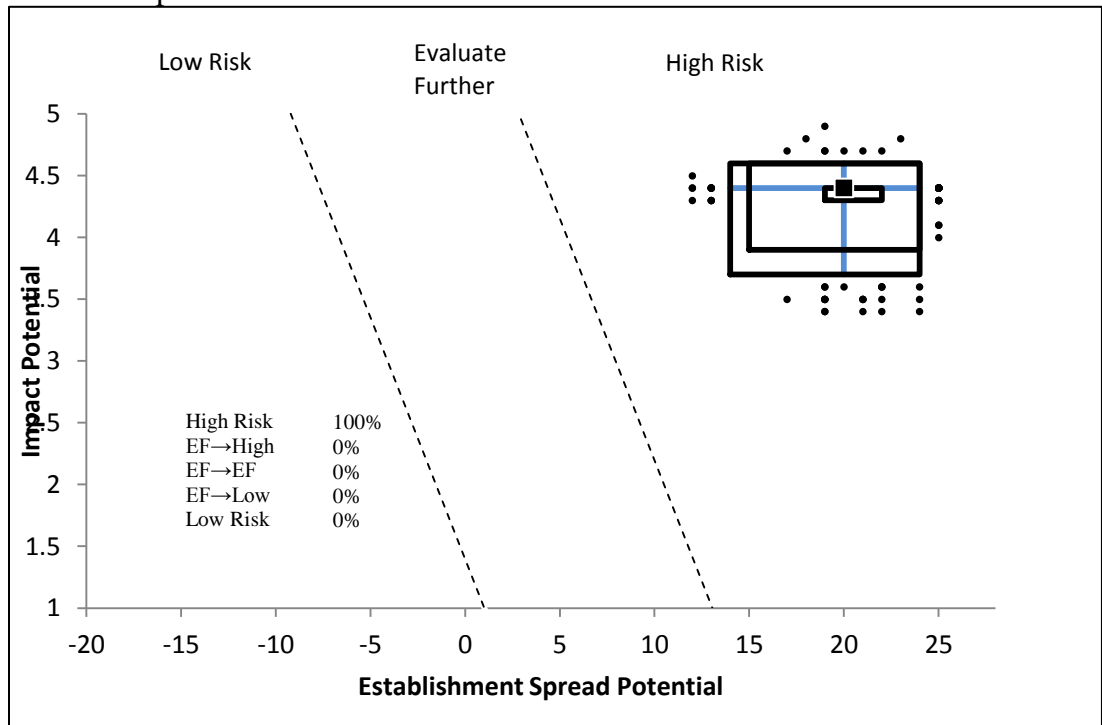


Figure 3. Model simulation results (N=5,000) for uncertainty around the risk score for *Cytisus scoparius*. The blue “+” symbol represents the medians of the simulated outcomes. The small-

est box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *Cytisus scoparius* is High Risk. The species shares traits in common with other major invaders (Fig. 2) used to develop and validate the PPQ WRA model. One hundred percent of the simulated risk scores received a rating of High Risk (Fig. 3), indicating that despite any uncertainty in the assessment, our conclusion of High Risk is robust. This is a well-studied species and numerous research projects and summaries of research have been written for this species.

Cytisus scoparius has a high establishment potential because of heavy seed production, a long-lasting seed bank and several methods of seed dispersal including accidental dispersal by humans (Bossard 2015; Zouhar 2005). It has numerous environmental impacts including increased fire frequency, changes in soil nutrients, allelopathy, formation of dense stands that alter habitat structure and lower species diversity, and threats to endangered plants and animals (Bossard 2015; Grove et al. 2012; Zouhar 2005). Only one group of researchers appears to have studied allelopathy in this species (Grove et al. 2012). *Cytisus scoparius* is considered a weed in forestry plantations and reforestation projects (CABI 2015; Bossard 2015). Seeds are toxic to livestock and horses (Washington State Noxious Weed Control Board 2015). Impacts to anthropogenic systems were less clear with some reports of changes to vistas in National Parks (CABI 2015) and removal from gardens because of its aggressive nature (Dave's Garden 2015).

Cytisus scoparius ranked as a Tier 2 species in the Maryland Filter assessment (Appendix B). It is naturalized in at least three counties in Maryland in the Coastal Plain, Piedmont and Appalachian Plateau (EDDMapS 2015) and could easily grow in other regions of Maryland (see the geographic analysis for this WRA). It has not been reported as occurring in close proximity to threatened or endangered species or communities in Maryland, but rather two to six miles away, and has been naturalized since at least 1950 (Norton Brown Herbarium 2015).

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Appendix A. Weed risk assessment for *Cytisus scoparius* (L.) Link (Fabaceae). The following information came from the original risk assessment, which is available upon request (full responses and all guidance). We modified the information to fit on the page.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 [What is the taxon's establishment and spread status outside its native range? (a) Introduced elsewhere =>75 years ago but not escaped; (b) Introduced <75 years ago but not escaped; (c) Never moved beyond its native range; (d) Escaped/Casual; (e) Naturalized; (f) Invasive; (?) Unknown]	f - negl	5	This species is native to Europe and North Africa (ARS 2015). "Scotch broom currently occupies more than 700,000 acres in central to northwest coastal and Sierra Nevada foothill regions of California" (Bossard 2015). "Scotch broom is an alien invasive plant taking over huge areas of the Pacific Northwest and worldwide." (BroomBusters 2014). Widely distributed in New Zealand and spreading into conservation and pastoral lands (Williams 1998). Alternative answers are both "e."
ES-2 (Is the species highly domesticated)	n - low	0	There are two subspecies, <i>C. scoparius</i> var. <i>scoparius</i> and <i>C. scoparius</i> var. <i>andreasii</i> (Puis.) Dipp. Many cultivars have been selected mainly for flower color (Dirr 2009), but there is little evidence of any increase or decrease in seed production in cultivars. Some research has been done on developing seedless cultivars through ploidy levels (Pooler 2013). Weeds of Australia (2011) reports that <i>C. scoparius</i> var. <i>andreasii</i> cultivars naturalize from seed. There are numerous cultivars of a hybrid, <i>Cytisus scoparius</i> x <i>dallimorei</i> which are considered "well behaved" (Paghat's Garden 2015) but there is no evidence at the species level of domestication that reduces its weed potential.
ES-3 (Weedy congeners)	y - negl	1	There are about 50 species in the genus <i>Cytisus</i> (Bailey and Bailey 1976). Randall (2012) lists a total of 21 species, and eight are listed as weeds and/or invasive. Two may be significant weeds based on the number of citations in Randall (2012) - <i>C. multiflorus</i> and <i>C. striatus</i> . Weber (2003) also lists <i>C. multiflorus</i> . Two closely related brooms currently classified under other genera are also significant weeds - <i>Genista monspessulana</i> , French broom; and <i>Spartium junceum</i> , Spanish broom (Oregon State University 2008; USDA PLANTS 2014; Randall 2012).
ES-4 (Shade tolerant at some stage of its life cycle)	n - low	0	The plant is found in open forests, and disturbed areas (Bossard 2015). Seedlings can establish in as little as 10% sunlight (Graves et al. 2010), but in general the plant grows in disturbed areas and performs best with moderate shade (Zouhar 2005).
ES-5 (Plant a vine or scrambling plant, or forms tightly appressed basal rosettes)	n - negl	0	Scotch broom grows as a prostrate or upright shrub (Zouhar 2005) and does not have a climbing or smothering growth habit.
ES-6 (Forms dense thickets, patches, or populations)	y - negl	2	Scotch broom forms dense stands (CRC Weed Management 2008; Zouhar 2005). A comparison of invaded sites in California showed 3 to 22 plants/m ² with biomass from 4110 to 4212 g/m ² (Parker 2000).
ES-7 (Aquatic)	n - negl	0	Plants are terrestrial shrubs and are not aquatic

Question ID	Answer - Uncertainty	Score	Notes (and references)
			(ARS 2015).
ES-8 (Grass)	n - negl	0	Scotch broom is in the Fabaceae family and therefore not a grass (ARS 2015).
ES-9 (Nitrogen-fixing woody plant)	y - negl	1	Scotch broom is a woody species in the Fabaceae family (ARS 2015). Nitrogen-fixing bacteria found in small nodules on plant roots can fix nitrogen even at temperatures to 38 °F (4 degrees C) (Bossard 2015).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	Scotch broom has "prodigious seed production" (Bossard 2015). Bossard and Rejmanek 1994 estimated the mean total number of viable seeds/shrub/year was 9650 at a site in California. A small proportion of flowers set seed, but there are many flowers per plant (CRC Weed Management 2008).
ES-11 (Self-compatible or apomictic)	y - mod	1	Scotch broom is self-compatible but sets selfed seeds at a very low rate (Parker and Haubensak 2002).
ES-12 (Requires specialist pollinators)	n - mod	0	Honeybees and bumblebees pollinate Scotch broom (CRC Weed Management 2008; Myer 2008). Although the flower morphology requires pollination by bumblebees or honeybees, because there are numerous species of these pollinators around the world we answered "no" with moderate uncertainty.
ES-13 [What is the taxon's minimum generation time? (a) less than a year with multiple generations per year; (b) 1 year, usually annuals; (c) 2 or 3 years; (d) more than 3 years; or (?) unknown]	c - low	-1	1 – 3% of plants flower at 2 years in an Australian study (Sheppard et al. 2002). Plants first flower at 3-5 years (CRC Weed Management 2008; Myers 1998). Seedlings flowered after 4 years (Paynter et al. 1998). Plants can become reproductive at 2 years (Bossard 2015). Answering "c" with alternative answers both "d."
ES-14 (Prolific reproduction)	y - negl	1	"It spreads by prodigious seed production. One medium-sized shrub can produce over 12,000 seeds a year." (Bossard 2014) and there may be 3 – 22 shrubs/m ² (Parker 2000). "A small proportion of flowers set seed but mature stands can produce abundant seed in favourable seasons due to many-seeded pods, large plants, dense populations and prolific flowering." (CRC Weed Management 2008)
ES-15 (Propagules likely to be dispersed unintentionally by people)	y - negl	1	"It can be carried inadvertently in soil by humans...or vehicles" (CRC Weed Management 2008); seeds are carried in mud on vehicles and road equipment (Bossard 2015).
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	? - max	2	Wallowa County OR inspects forage crops for possible contamination by this and other species (Wallowa County 2015).
ES-17 (Number of natural dispersal vectors)	4	4	Seeds are contained in flattened hairy pods that open explosively to disperse seeds. Each pod contains 5-8 seeds. Seeds have a tough seed coat and are about an 1/8 of an inch in diameter.
ES-17a (Wind dispersal)	n - low		We found no evidence of wind dispersal.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-17b (Water dispersal)	y - negl		Seeds float for several hours and disperse along rivers during floods (Waterson and Jones 2006). Seeds are dispersed by rain wash on slopes (Bossard 2015). The hard seed coat makes it likely that seeds could survive floods (Williams 1981). Plants dominate extensive river floodplain areas in part of New Zealand (Williams 1981).
ES-17c (Bird dispersal)	n-high		Birds may disperse seeds but are also occasionally seed predators (Zouhar 2005), and we found no direct evidence to support seed dispersal by birds.
ES-17d (Animal external dispersal)	y - negl		<i>Cytisus</i> seeds have an eliasome that attracts ants (Myers 1998), and plants are sometimes found in high densities around ant nests (Zouhar 2005). Seeds sometimes carried inadvertently in soil ... by animals (CRC Weed Management 2008).
ES-17e (Animal internal dispersal)	y - mod		Animals including rodents and goats may occasionally disperse seeds (Zouhar 2005). 8% of seeds fed to goats remained viable (Zouhar 2005).
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	y - negl	1	Seeds persist at least 5 years and up to 30 years (Bossard 2015). Seeds persist for 20 years or more (CRC Weed Management 2008)
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	y - mod	1	Plants resprout when cut (Bossard 2015). "Generally resprouts from the base". "After cutting or chopping with mechanical equipment, broom may resprout from root crowns in greater density" (Hoshovsky 1986).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	n - low	0	We found no evidence of herbicide resistance. <i>Cytisus</i> is not listed in Heap (2015).
ES-21 (Number of cold hardiness zones suitable for its survival)	8	0	
ES-22 (Number of climate types suitable for its survival)	9	2	
ES-23 (Number of precipitation bands suitable for its survival)	10	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	y - mod	0.1	In a greenhouse study, Grove et al. (2012) found that <i>Cytisus scoparius</i> leaf litter suppressed growth of Douglas fir seedlings possibly by suppressing growth of ectomycorrhizal fungi. A previous study cited by the authors demonstrated poor growth of Douglas fir seedlings in areas previously invaded by <i>C. scoparius</i> .
Imp-G2 (Parasitic)	n - negl	0	We found no evidence. Furthermore, plants in the Fabaceae family (ARS 2015) are not known to be parasitic (Nickrent 2015).
Impacts to Natural Systems			
Imp-N1 (Changes ecosystem processes and parameters that affect other species)	y - negl	0.4	Scotch broom increases fire frequency and intensity, fixes nitrogen, and tends to acidify soils (Bossard 2015; Zouhar 2005). Changes carbon to nitrogen ratios in soils (Haubensak and Parker 2004).
Imp-N2 (Changes habitat structure)	y - negl	0.2	This plant forms dense stands of shrubs in

Question ID	Answer - Uncertainty	Score	Notes (and references)
			grasslands and lowland prairies (Zouhar 2005). Grasses are outcompeted as Scotch broom stands in grasslands mature (Srinivasan et al. 2007). "The invasion of <i>C. scoparius</i> [in a grassland] involves a dramatic increase in plant density, from scattered individuals to a near monoculture involving several kilograms of plant material per square meter" (Parker, 2000).
Imp-N3 (Changes species diversity)	y - negl	0.2	Shades out understory plants and tree seedlings (Weeds of Australia 2015; Downing and Smith 2000). Decreased species diversity in Australian subalpine vegetation (Wearne and Morgan 2004).
Imp-N4 (Is it likely to affect federal Threatened and Endangered species?)	y - negl	0.1	In Idaho fescue grasslands and Oregon white oak woodlands, numerous species are threatened including the western gray squirrel, western pocket gopher, and several species of birds, reptiles, amphibians, and butterflies as well as several plant species (Zouhar 2005). In Queensland, Australia it threatens the Barrington Tops ant orchid (<i>Chiloglottis platyptera</i>), the veined doubletail orchid (<i>Diurus venosa</i>), the leafy greenhood orchid (<i>Pterostylis cucullata</i>), the elegant greenhood orchid (<i>Pterostylis elegans</i>), the slaty leaf orchid (<i>Prasophyllum fuscum</i>), polblue eyebright (<i>Euphrasia ciliolata</i>), fragrant pepperbush (<i>Tasmannia glaucifolia</i>), broad-leaved pepperbush (<i>Tasmannia purpurascens</i>) and the broad-toothed rat (<i>Mastacomys fuscus</i>) (Weeds of Australia 2015).
Imp-N5 (Is it likely to affect any globally outstanding ecoregions?)	y - negl	0.1	Scotch broom is considered a serious invader in the Sierra Nevada foothills and western coastal forests (Bossard, 2015), which are considered globally outstanding ecoregions (Ricketts et al. 1999) Based on the impacts described under Imp-N1 and Imp-N2, Scotch broom represents a significant threat to these ecoregions.
Imp-N6 [What is the taxon's weed status in natural systems? (a) Taxon not a weed; (b) taxon a weed but no evidence of control; (c) taxon a weed and evidence of control efforts]	c - negl	0.6	Multiple environmental groups and local governments identify scotch broom as a weed in natural areas and work to control it: BroomBusters (2015) grassroots control campaign in Vancouver and British Columbia; New South Wales control manual (CRC Weed Management 2008); King County Washington best management practices document (King County, 2008). Alternative answers for Monte Carlo simulation are both "b."
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Negatively impacts personal property, human safety, or public infrastructure)	n - low	0	We found no evidence of broom impacting human property, processes, civilization or safety.
Imp-A2 (Changes or limits recreational use of an area)	y - low	0.1	Homeowners in Oregon remove scotch broom to improve access to the beach (Bengel 2015). Considered detrimental to tourism by BroomBusters (2015): "The bright yellow flowers

Question ID	Answer - Uncertainty	Score	Notes (and references)
			of broom are pretty at a distance for a couple months of the year. But then it becomes a scraggly, half dead presence, blocking and overwhelming the beautiful fields, flowers and forests of our Island. Broom has become a serious tripping hazard on hiking and mountain bike trails. All of these things make Vancouver Island less enjoyable than it was." It changes vistas within several National Parks in the US and Australia (CABI 2015).
Imp-A3 (Affects desirable and ornamental plants, and vegetation)	y - mod	0.1	There are numerous reports of removal from gardens mostly in the Pacific Northwest (Dave's Garden 2015). "You can't understand quite what a menace this plant is until you've spent days 'pulling' it out by its tenacious roots on a volunteer basis. My blistered hands and sore back will tell you that planting Scotch Broom in California is a crime against nature." (Dave's Garden 2015).
Imp-A4 [What is the taxon's weed status in anthropogenic systems? (a) Taxon not a weed; (b) Taxon a weed but no evidence of control; (c) Taxon a weed and evidence of control efforts]	c - mod	0.4	Scotch broom is common in disturbed areas and is commonly planted as a garden ornamental. Because of reports of the difficulty in removing from gardens we answered "c" with moderate uncertainty. Alternative answers for the Monte Carlo simulation are "b" and "a."
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	y - low	0.4	This plant shades out tree seedlings in reforestation projects and reduces native forage (Bossard 2015); however, it is not clear if the reforestation projects were plantations for harvest. "It is estimated that Scotch broom costs Oregon \$47 million dollars annually in lost timber production and control costs" (Oregon Department of Agriculture 2015).
Imp-P2 (Lowers commodity value)	n - low	0	We found no evidence of scotch broom lowering a commodity value.
Imp-P3 (Is it likely to impact trade?)	n - low	0	We found no evidence of scotch broom impacting trade although it is listed as a regulated organism by New Zealand (APHIS 2015) and as a noxious weed in several states (USDA PLANTS 2015). We could not find evidence that seeds could follow the pathway of a traded commodity.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - low	0	We found no evidence of scotch broom affecting irrigation or competing with crops for water.
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	y - low	0.1	The plant's seeds are toxic to some ungulates: "foliage causes digestive disorders in horses" (Bossard 2015). Seeds are toxic to livestock and horses (Washington State Noxious Weed Control Board 2015).
Imp-P6 [What is the taxon's weed status in production systems? (a) Taxon not a weed; (b) Taxon a weed but no evidence of control; (c) Taxon a weed and	c - low	0.6	It occurs as a weed in Eucalyptus and pine plantations (CABI 2015). "Pasture land is made useless" (BroomBusters 2015). Scotch broom is considered a weed in forest production systems and

Question ID	Answer - Uncertainty	Score	Notes (and references)
evidence of control efforts]			rangelands (Bossard 2015; CABI 2015; Oregon Department of Agriculture 2015). Alternative answers are both "b" for the Monte Carlo simulation.
GEOGRAPHIC POTENTIAL			Unless otherwise indicated, the following evidence represents geographically referenced points obtained from the Global Biodiversity Information Facility (GBIF).
Plant hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z2 (Zone 2)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z3 (Zone 3)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z4 (Zone 4)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z5 (Zone 5)	y - negl	N/A	Points occur in Austria, eastern Canada, Finland, France, Italy, Switzerland and in the US in WA and MT.
Geo-Z6 (Zone 6)	y - negl	N/A	Distribution is widespread in east and western Europe, western Canada, both coasts of the US, Scandinavia, New Zealand and Japan.
Geo-Z7 (Zone 7)	y - negl	N/A	Multiple points occur as in Zone 6, with additional points in Argentina, Australia, Peru
Geo-Z8 (Zone 8)	y - negl	N/A	Points occur in Argentina, Australia, Bolivia, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Peru, Poland, South Africa, Spain, Sweden, United Kingdom and the US (CA, MD, OR, VA, WA).
Geo-Z9 (Zone 9)	y - negl	N/A	Points occur in Australia, Canada, Chile, France, Italy, Japan, Morocco, the Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, United Kingdom and the US (CA, OR, WA).
Geo-Z10 (Zone 10)	y - negl	N/A	Points occur in Australia and New Zealand, Italy, Japan, Portugal, Spain, France and in the US in CA, OR and WA states.
Geo-Z11 (Zone 11)	y - low	N/A	While occurrences are documented in Australia (Tasmania), Chile, Ecuador, and France (Corsica), Page (2001) reports Zones 5-9 for this species, so we are answering yes with low uncertainty.
Geo-Z12 (Zone 12)	y - mod	N/A	Multiple points on the Canary Islands, Madeira, and a single well-documented point in India.
Geo-Z13 (Zone 13)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Köppen -Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
Geo-C2 (Tropical savanna)	n - high	N/A	Single points occur in Ecuador and India, The Ecuadorean point is listed as present on a "country estate" and may be cultivated. The Indian point occurs at a relatively high elevation, and is close to

Question ID	Answer - Uncertainty	Score	Notes (and references)
			the boundary of the K-G humid subtropical climate class. This is a temperate zone plant, so we answered "no" with high uncertainty.
Geo-C3 (Steppe)	y - low	N/A	Points occur in Argentina, Australia, South Africa, Spain and in the US in WA.
Geo-C4 (Desert)	y - mod	N/A	Several points occur on the Atlantic islands of Spain, and one in WA state in the US.
Geo-C5 (Mediterranean)	y - negl	N/A	Points occur in Australia, Canada, Chile, France, Italy, Morocco, South Africa, Spain, Portugal and in the US in CA and WA.
Geo-C6 (Humid subtropical)	y - negl	N/A	The species is documented in Australia, India, Germany, Japan, and the southeast and mid-Atlantic US.
Geo-C7 (Marine west coast)	y - negl	N/A	This plant's widest distribution occurs in this zone. It is present in Australia, New Zealand, Chile, Peru, South Africa, Madagascar, throughout Europe and the UK, in Norway and in the US (WA).
Geo-C8 (Humid cont. warm sum.)	y - negl	N/A	Points in Japan, and northwestern and northeastern US.
Geo-C9 (Humid cont. cool sum.)	y - negl	N/A	Widely distributed within this zone in Europe and North America.
Geo-C10 (Subarctic)	y - low	N/A	Occurs in mountainous regions of Finland, France, Germany, Norway, Slovenia and Spain.
Geo-C11 (Tundra)	y - low	N/A	Points in Austria, France, Norway and Switzerland.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	n - low	N/A	Although points in this zone are noted, the single one in South Africa is at 1300 meters elevation, and those on Tenerife in the Canary Islands appear to be located on mountain slopes where higher moisture levels are likely to be present.
Geo-R2 (10-20 inches; 25-51 cm)	y - negl	N/A	Points exist on the eastern Atlantic islands of France, Spain and along Portugal's southern coast, and in CA in the US.
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	Multiple points in eastern and western Europe, Scandinavia, Australia, New Zealand, Chile, South Africa and the US.
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	Widely distributed in Europe, with additional points in Scandinavia, Australia, New Zealand, Chile, South Africa and the US.
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	Widely distributed in Europe, with additional points in Scandinavia, Australia, New Zealand, Argentina, Chile, South Africa and the US.
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	Widely distributed in Europe, with additional points in Canada, Scandinavia, India, Australia, New Zealand, Argentina, Chile, South Africa and the US.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	Points in Austria, Norway, Portugal, France, the UK and Ireland, Germany, Australia, New Zealand, Chile and the US.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-R8 (70-80 inches; 178-203 cm)	y - negl	N/A	Points in Argentina, Austria, Canada, Chile, France, Italy, Japan, Germany, Madagascar, New Zealand, South Africa, the UK and the US
Geo-R9 (80-90 inches; 203-229 cm)	y - negl	N/A	Points in Argentina, Canada, France, Germany, Japan, New Zealand, Norway, the UK and the US
Geo-R10 (90-100 inches; 229-254 cm)	y - negl	N/A	Points in Belgium, Canada, Japan, New Zealand, Norway, the UK and the US
Geo-R11 (100+ inches; 254+ cm)	y - negl	N/A	Canada, Ecuador, India, New Zealand and Norway
ENTRY POTENTIAL			
Ent-1 (Plant already here)	y - negl	1	Scotch broom and cultivars and hybrids of Scotch broom are widely planted as ornamentals across the United States. Listed as a noxious weed in four western states and Hawaii (USDA PLANTS 2015).
Ent-2 (Plant proposed for entry, or entry is imminent)	-	N/A	
Ent-3 (Human value & cultivation/trade status)	-	N/A	
Ent-4 (Entry as a contaminant)			
Ent-4a (Plant present in Canada, Mexico, Central America, the Caribbean or China)	-	N/A	
Ent-4b (Contaminant of plant propagative material (except seeds))	-	N/A	
Ent-4c (Contaminant of seeds for planting)	-	N/A	
Ent-4d (Contaminant of ballast water)	-	N/A	
Ent-4e (Contaminant of aquarium plants or other aquarium products)	-	N/A	
Ent-4f (Contaminant of landscape products)	-	N/A	
Ent-4g (Contaminant of containers, packing materials, trade goods, equipment or conveyances)	-	N/A	
Ent-4h (Contaminants of fruit, vegetables, or other products for consumption or processing)	-	N/A	
Ent-4i (Contaminant of some other pathway)	-	N/A	
Ent-5 (Likely to enter through natural dispersal)	-	N/A	

Appendix B. Maryland Filter assessment for *Cytisus scoparius* (L.) Link (Fabaceae).

Maryland Filter questions	Answer	Notes
1. Is the plant currently naturalized in Maryland? yes OR no	yes	Reported as naturalized in Alleghany, Montgomery and Cecil County (EDDMapS 2015). Also reported in Anne Arundel, Calvert, Charles and Prince Georges counties in either BONAP (2015) or the Norton Brown Herbarium at University of Maryland (2015). Some of these records could not be verified.
2. What is the species' potential distribution in Maryland? wide OR narrow	wide	Could occupy most of the physiographic provinces in Maryland (WRA); does occupy Piedmont and Alleghany Mountain provinces (EDDMapS 2015).
3. Does or could the species harm threatened or endangered Maryland species or community types or CITES listed species occurring in MD? yes OR no	?	No documentation of harm exists at this time.
4. How feasible is control of the species? easy OR difficult	difficult	Seed bank can last 5 - 30 years; plants resprout when cut (Bossard, 2015).
5. Is added propagule pressure from sales significantly increasing potential of the species to persist and spread? yes OR no	no	Scotch broom has been in Maryland since at least 1950 (Norton Brown Herbarium 2015).