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Weed Risk Assessment for *Carex pendula* Huds. (Cyperaceae) – Pendulous sedge

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Hanging or pendulous inflorescences of *Carex pendula* (source: Taylor, 2012; © 2009 Dean Wm. Taylor, Ph.D.).

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Introduction Plant Protection and Quarantine (PPQ) regulates noxious weeds under the authority of the Plant Protection Act (7 U.S.C. § 7701-7786, 2000) and the Federal Seed Act (7 U.S.C. § 1581-1610, 1939). A noxious weed is defined as “any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment” (7 U.S.C. § 7701-7786, 2000). We use weed risk assessment (WRA) - specifically, the PPQ WRA model (Koop et al., 2012) - to evaluate the risk potential of plants, including those newly detected in the United States, those proposed for import, and those emerging as weeds elsewhere in the world.

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 area within it. As part of this analysis, we use a stochastic simulation to evaluate how much the uncertainty associated with the analysis affects the model outcomes. We also use GIS overlays to evaluate those areas of the United States that may be suitable for the establishment of the plant. For more information on the PPQ WRA process, please refer to the document, *Background information on the PPQ Weed Risk Assessment*, which is available upon request.

***Carex pendula* Huds. – Pendulous sedge**

Species Family: Cyperaceae

Information Initiation: Al Tasker, past Federal Noxious Weed Program Manager with USDA-APHIS, requested that *Carex pendula* be evaluated for addition to the Federal Noxious Weed list on August 23, 2012, in response to its listing as an unwanted organism by New Zealand (Tasker, 2012). New Zealand added *Carex pendula* to its National Plant Pest Accord List, making it illegal to propagate, distribute, or sell this species there (Garden NZ, 2012; NPPA, 2012).

Foreign distribution: *Carex pendula* is native to the United Kingdom (French and Murphy, 1994), to west Asia and to north Africa (Simpson and Inglis, 2001; Stace, 2010). This plant is naturalized in Australia (New South Wales, Victoria) (Randall, 2007) and New Zealand (Howell and Sawyer, 2006; Reznicek, 2002).

U.S. distribution and status: *Carex pendula* is cultivated as an ornamental in the United States (Bryson and Carter, 2008), including North Carolina (Plant Delights Nursery, 2013), Illinois (Basinger, 2001), Oregon, and Washington (Burke Herbarium, 2012). The collections in the Burke Herbarium include cultivated, adventive, and naturalized plants, and indicate that the plant is spreading: new entries have been submitted to the herbarium every year or two from new or expanding locations (Burke Herbarium, 2012). *Carex pendula* is also spreading in California and Illinois

(Basinger, 2001; Calflora, 2012; USDA NRCS, 2012; Weakley, 2010). Plants are naturalized on roadsides, stream banks, and along “intermittent drainage” (Reznicek, 2002; Basinger, 2001). The first report of *C. pendula* in the United States was in Virginia along a roadside in a military installation in the late 1970s or early 1980s (Virginia Botanical Associates, 2013; Weakley, 2010), but we found no additional evidence of spread in the southeast.

WRA area¹: Entire United States, including territories

1. *Carex pendula* analysis

Establishment/Spread Potential *Carex pendula* is a perennial forest sedge (Schütz, 2000; Brandel, 2005; Brändel and Schütz, 2005) that grows in full to partial shade (Cochrane, n.d.; Brandel, 2005; Brändel and Schütz, 2005), and on wet to moist nutrient-rich soils (Cochrane, n.d.). A cespitose (tufted, clumping) herb (eFloras, 2008), *C. pendula* has “a propensity to self-sow” and is appearing outside cultivation, naturalized on roadsides, stream banks, and along “intermittent drainage[s]” (Kelly, 2011; Basinger, 2001; Burke Herbarium, 2012; Reznicek, 2002; Basinger, 2001). It reproduces by seed and rhizomes (Cochrane, n.d.), producing more than 20,000 seeds/plant in favorable conditions (Brändel and Schütz, 2005). Also in favorable conditions (light, 15-20°C), more than 90 percent of the seeds germinate (Schütz, 2000). Seeds disperse primarily by water, but the plant is being spread by humans as an ornamental (Parsons and Cuthbertson, 2001). We had an average amount of uncertainty associated with this element.

Risk score = 9 Uncertainty index = 0.15

Impact Potential We found limited evidence of impacts caused by *C. pendula*, perhaps because it is not a significant weed. Or it may be that this species is newly escaped and has not had enough time to express its potential impacts or have them documented and reported. Still, New Zealand lists *C. pendula* as a prohibited species (unwanted organism) because it can displace a wide range of native species in wetlands (NPPA, 2012; MPI, 2012). *Carex pendula* is also on the “watch list” for British Columbia (IPCBC, 2010). We had a high degree of uncertainty for this risk element because relatively little published information is available on this species’ impacts; most of the information we cited we found on websites.

Risk score = 2.3 Uncertainty index = 0.29

Geographic Potential Based on three climatic variables, we estimate that about 70 percent of the United States is suitable for the establishment of *C. pendula* (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

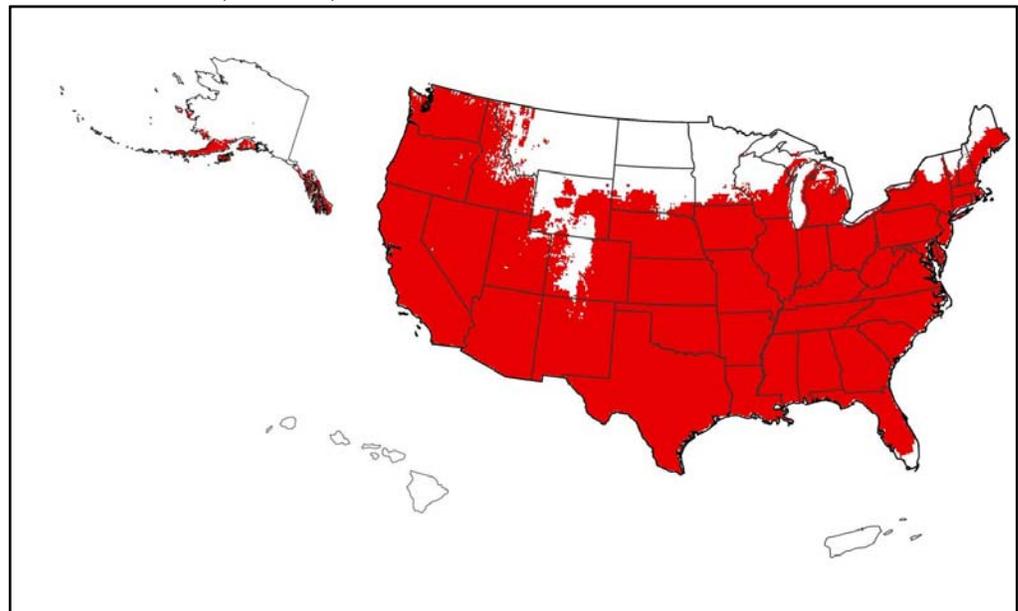
¹ “WRA area” is the area in relation to which the weed risk assessment is conducted [definition modified from that for “PRA area” (IPPC, 2012)].

map for *Carex pendula* represents the joint distribution of Plant Hardiness Zones 5-10, areas with 0-100 inches of annual precipitation, and the following Köppen-Geiger climate classes: steppe, Mediterranean, humid subtropical, marine west coast, humid continental warm summers, humid continental cool summers, and subarctic. The geographic potential may also be impacted by some undetermined environmental parameters. For instance, the cultivar ‘Moonraker’ is noted to grow to 2 ft in height in North Carolina gardens, whereas it is grows to 4-6 ft in West Coast states (Plant Delights Nursery, 2013). It was not clear if *C. pendula* occurs in climates with humid continental warm summers, but here we assumed those climate types were suitable.

The area estimated in Fig. 1 likely represents a conservative estimate as it uses three climatic variables to estimate the area of the United States that is suitable for establishment of the species. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. For example, *C. pendula* typically occurs in rich, heavy soils in woods and damp copses (Stace, 2010).

Entry Potential We did not assess the entry potential for *Carex pendula* because this species is already present in the United States (Basinger, 2001; Burke Herbarium, 2012; USDA NRCS, 2012; Weakley, 2010).

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



2. Results and Conclusion

Model Probabilities: P(Major Invader) = 34.7%
P(Minor Invader) = 59.9%
P(Non-Invader) = 5.4%

Risk Result = Evaluate Further

Secondary Screening = Evaluate Further

Figure 2. *Carex pendula* 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.

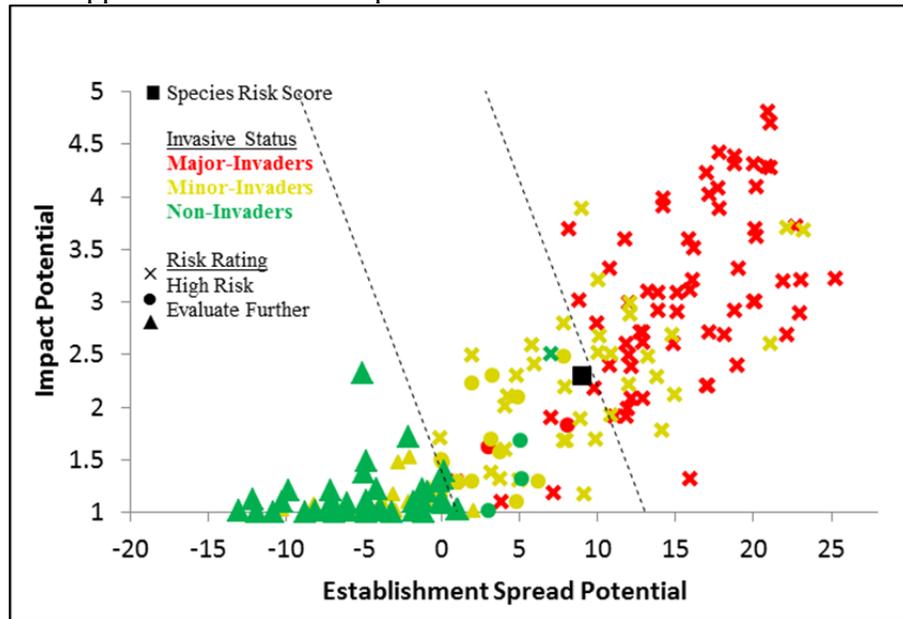
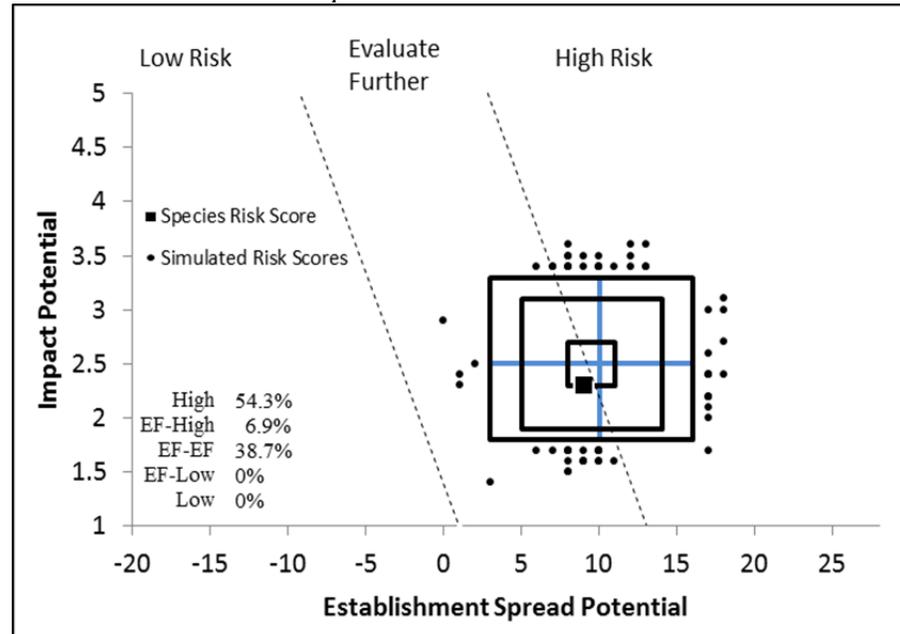


Figure 3. Monte Carlo simulation results (N=5,000) for uncertainty around the risk scores for *Carex pendula*^a.



^aThe blue “+” symbol represents the medians of the simulated outcomes. The smallest 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 *Carex pendula* is Evaluate Further, even after secondary screening (Fig. 2). Given the proximity of this species’ risk score to the High Risk threshold, and the relatively high uncertainty associated with the Impact Risk element, it is not surprising that about 73 percent of the simulated risk scores resulted in a determination of High Risk (Fig. 3).

Although we estimated that about 70 percent of the United States is suitable for this species (Fig. 1), this species is likely to primarily invade riparian areas. *Carex pendula*, which is already present in the United States, grows best in moist soils, and has been found naturalizing in riparian and moist sites, including drainage areas, waterways, stream banks, and along roadways (Seifert, 2008; Kelly, 2011; Reznicek, 2002). Given its prolific reproduction (Brändel and Schütz, 2005) and ability to disperse in water (Moggridge and Grunell, 2010), this species is likely to continue spreading in these areas. Some garden websites, especially in reference to drier climates, indicate careful attention to the water supply is required to establish and maintain this sedge in gardens (Dave’s Garden, 2012; Kelly, 2011), which supports our argument that riparian areas are vulnerable to invasion by this species.

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Appendix A. Weed risk assessment for *Carex pendula* Huds. (Cyperaceae). The following information was obtained from the species' risk assessment, which was conducted using Microsoft Excel. The information shown in this appendix was modified to fit on the page. The original Excel file, the full questions, and the guidance to answer the questions are available upon request.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Establishment/Spread Potential			
ES-1 (Status/invasiveness outside its native range)	e - negl	2	<i>Carex pendula</i> "has begun to invade wildlands in Washington, Oregon, and Virginia" in the United States (Seifert, 2008; Burke Herbarium, 2012) and is reported in wildlands in five counties in California (Alameda, Butte, Contra Costa, Marin, San Mateo) (Calflora, 2012). <i>Carex pendula</i> is escaping from cultivation (Kelly, 2011; Reznicek, 2002). It has spread from cultivation and naturalized along areas with "intermittent drainage" in woods in Illinois (Basinger, 2001). In New Zealand, it is fully naturalized (Howell and Sawyer, 2006), forming "a population self-maintained by seed or vegetative reproduction, or ...[occurs] repeatedly in natural or semi-natural habitats or in urban environments" (Webb et al., 1988). Naturalized in Australia (Victoria and New South Wales) (Randall, 2007). Alternate answers for the Monte Carlo simulation were "f" and "d."
ES-2 (Is the species highly domesticated)	n - mod	0	Cultivated as an ornamental (Reznicek, 2002). Many cultivars offered for sale by various nurseries (Backyard Gardener, 2012). We found no evidence that any cultivar has been selected for traits that would impact invasiveness.
ES-3 (Weedy congeners)	y - low	1	No <i>Carex</i> species is listed as a U.S. Federal Noxious Weed (7 CFR § 360, 2011). <i>Carex leporina</i> is a principle weed in New Zealand (Holm et al., 1979). Four native species of <i>Carex</i> (<i>C. buchananii</i> , <i>C. comans</i> , <i>C. flagellifera</i> , and <i>C. testacea</i>) are considered weedy in Australia, primarily in pastures and lucernes, and are spreading due to increasing use as ornamentals (Parsons and Cuthbertson, 2001). The congener <i>C. kobomugi</i> (Japanese sedge, Asiatic sand sedge), from China, is listed as invasive (Zheng et al., 2005).
ES-4 (Shade tolerant at some stage of its life cycle)	y - low	1	"Shade tolerant" and "occurs on wet to moist forest on nutrient rich soils" (Brändel and Schütz, 2005). Grows in full to partial shade (Cochrane, n.d.), and is tolerant of some shade (Brown and Oosterhuis, 1981).
ES-5 (Climbing or smothering growth form)	n - negl	0	A member of the Cyperaceae, <i>C. pendula</i> is a cespitose (Burke Herbarium, 2012), upright perennial sedge, and an individual plant (clump from a single stem) can grow and expand outwards to form a clump 0.5 to 1 meter in diameter (RHS, 2011). This species is not a vine nor does it have a smothering growth form.
ES-6 (Forms dense thickets)	n - mod	0	We found no evidence.
ES-7 (Aquatic)	n - mod	0	<i>Carex pendula</i> is common along streams, and is reported from bogs and boggy soils (Seifert, 2008; Kelly, 2011), forest and waterways (Smith, 2012), and stream banks and roadways (Reznicek, 2002). <i>Carex pendula</i> "is sometimes cultivated, especially in water gardens" (Reznicek, 2002). Thus although it may occur in wet habitats, we found no evidence it is an aquatic species as defined by this question.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-8 (Grass)	n - negl	0	Member of the Cyperaceae (Smith, 2012), not the Poaceae.
ES-9 (Nitrogen-fixing woody plant)	n - low	0	We found no direct evidence this species fixes nitrogen. Because this species is an herbaceous perennial and not woody, we answered no. We note that that the congener <i>C. stricta</i> fixes nitrogen (acetylene reduction), especially by plants in moist soils (Eckardt and Biesboer, 1988).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	Produces viable seed (Brändel and Schütz, 2005).
ES-11 (Self-compatible or apomictic)	? - max	0	<i>Carex pendula</i> has unisexual spikes, the upper spikes are male, single, 2.5-4 inches, while the lower 4-5 spikes are female, distant, and pedunculate (Molino et al., 2006; Bailey and Bailey, 1976). This species reportedly self-sows (Christman, 2004; eFloras, 2008), but it is not clear if it is self-compatible.
ES-12 (Requires special pollinators)	n - low	0	<i>Carex pendula</i> is wind pollinated; pollen is released as spikes move in the wind (image, Encyclopedia Britannica, 2012). Thus, this species does not require specialized pollinators.
ES-13 (Minimum generation time)	c - high	0	We found no evidence that this plant reproduces within its first year. This perennial takes 2-5 years to reach its maximum height (RHS, 2011). Given that, it probably reaches reproductive maturity in 2-3 years. Further, because it is herbaceous, it is highly unlikely to take four or more years to reach reproductive maturity. Based on our level of speculation here, the degree of uncertainty is high. Alternate answers for the Monte Carlo simulation were “b” and “d.”
ES-14 (Prolific reproduction)	y - negl	1	It is a herbaceous perennial producing more than 20,000 seeds/plant (i.e., clump) in favorable conditions (Brändel and Schütz, 2005). Plants grow to form clumps that are 0.5 to 1 meter in diameter (RHS, 2011). Seed germination is best with light following stratification and in moist, forest soils (Schultz and Rave, 1999). At 15-20°C a germination rate of 90 percent has been reported (Schütz, 2000).
ES-15 (Propagules likely to be dispersed unintentionally by people)	y - high	1	Seed collected from soil on vehicles produced seedlings in one study (Hodkinson and Thompson, 1997), but not in another (Zwaenepoela et al., 2006). Because only one seedling was recovered out of 201 samples collected (Hodkinson and Thompson, 1997), however, we rated the uncertainty as high.
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	n - mod	-1	We found no evidence.
ES-17 (Number of natural dispersal vectors)	1	-2	Description of fruit and seed characteristics for questions ES-17a through ES-17e: fruit are “1.3–1.6 mm, 1–1.3 mm wide; perigynium ... 2.6–4 mm, 1.1–1.5 mm wide, body elliptic, plump, ± inflated, glabrous, green, brown-streaked, margin not flat, beak smooth, 0.5 mm” (Smith, 2012).
ES-17a (Wind dispersal)	n - mod		This species is primarily dispersed by water, with one report that it is also dispersed "by wind and people" (Seifert, 2008). We consider this one report as insufficient evidence for wind dispersal.
ES-17b (Water dispersal)	y - low		"Seed are primarily dispersed by water..." (Seifert, 2008). Viable propagules of <i>C. pendula</i> are dispersed by water (Moggridge and Grunell, 2010); the authors did not indicate if the propagules were seed or rhizomes. This plant is appearing along roadsides and stream banks (Reznicek, 2002; eFloras,

Question ID	Answer - Uncertainty	Score	Notes (and references)
			2008).
ES-17c (Bird dispersal)	n - low		We found no evidence of bird dispersal.
ES-17d (Animal external dispersal)	n - low		<i>Carex pendula</i> provides habitat for wildlife (FMP, 2012), but the seed do not have features that would promote attachment to animals. We found no direct evidence of animal (external) dispersal.
ES-17e (Animal internal dispersal)	n - mod		<i>Carex pendula</i> provides food for wildlife (FMP, 2012), but we found no evidence that animals disperse seeds.
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	y - low	1	<i>Carex pendula</i> undergoes dormancy, which is broken with a combination of light and cold temperatures (Brandel, 2005). <i>Carex pendula</i> has been recovered from seed banks, once after almost three years (Brandel, 2005). It has also been recovered from mineral soil up to two years after the soil was collected (Brown and Oosterhuis, 1981), and recovered from soil in a 45-year-old managed oak woodland (Warr et al., 1994). In other studies, however, it was not recovered from soil in unmanaged (not disturbed) oak woodlands (Warr et al., 1994), nor in old growth <i>Buxus</i> stands in Iran (Asadi et al., 2012).
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	y - low	1	Once fully established, <i>Carex pendula</i> responds well to annual cutting to the ground (Wareham, 2012). <i>Carex pendula</i> grows in riparian/paludal (marshy) habitats, and therefore has the following post-fire response: "Not usually burnt in applied (cool season) fires, but may be burnt in wildfire conditions, if burnt: regenerate rapidly post-fire" (Zimmer et al., 2012).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	n - mod	0	We found no reports of herbicide resistance for any species in this genus <i>Carex</i> (e.g., Holt and Lebaron, 1990; Heap, 2013).
ES-21 (Number of cold hardiness zones suitable for its survival)	6	0	
ES-22 (Number of climate types suitable for its survival)	7	2	
ES-23 (Number of precipitation bands suitable for its survival)	10	1	
Impact Potential			
General Impacts			
Imp-G1 (Allelopathic)	n - mod	0	We found no evidence.
Imp-G2 (Parasitic)	n - negl	0	The Cyperaceae family is not known to contain parasitic plants (Heide-Jorgensen, 2008; Nickrent, 2009).
Impacts to Natural Systems			
Imp-N1 (Change ecosystem processes and parameters that affect other species)	n - high		We found no evidence that <i>C. pendula</i> changes ecosystem processes.
Imp-N2 (Change community structure)	n - high	0.2	We found no evidence.
Imp-N3 (Change community composition)	y - high	0.2	<i>Carex pendula</i> can displace native plant species and any dependent invertebrate and wildlife species (Seifert, 2008). "This plant can displace native species in a wide range of habitats (particularly wetlands) due to its large size and prolific seeding capacity" (MPI, 2012). Because of its large size and prolific seeding it can displace native species in a range of

Question ID	Answer - Uncertainty	Score	Notes (and references)
			habitats" (Weedbusters, 2008). We used high uncertainty because it was not clear from these sources to what extent <i>C. pendula</i> has this impact.
Imp-N4 (Is it likely to affect federal Threatened and Endangered species)	y- high	0.1	"Because of its large size and prolific seeding it can displace native species in a range of habitats. It is a threat to natural areas and restoration projects, especially near waterways and wetlands" (Weedbusters, 2008). Invades natural riparian areas and could impact a wide range of native species (McDonald, 2010). "Personal observations suggest that <i>C. pendula</i> is salt tolerant and could also begin to encroach into estuarine environments" (McDonald, 2010). U.S. Threatened and Endangered species occur in riparian and woodland habitats similar to those where <i>C. pendula</i> occurs but we used high uncertainty because we found no direct evidence of this plant affecting such species.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions)	n - mod	0.1	We found no evidence.
Imp-N6 (Weed status in natural systems)	c - low	0.6	Under regulatory control in New Zealand with prohibitions on propagation and sale of plants, and the Christchurch City Council is controlling <i>C. pendula</i> along the Heathcote River (MPI, 2012; NPPA, 2012; McDonald, 2010). Alternate answers for the Monte Carlo simulation were both "b."
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Impacts human property, processes, civilization, or safety)	n - mod	0	We found no evidence.
Imp-A2 (Changes or limits recreational use of an area)	n - mod	0	We found no evidence.
Imp-A3 (Outcompetes, replaces, or otherwise affects desirable plants and vegetation)	? - max	0.1	Garden sites listed <i>C. pendula</i> as unwanted or a nuisance plant and recommend controlling this species (Garden Lilly, 2011; Hegarty Webber, 2011), but did not directly provide evidence of species impacts. We suspect it outcompetes other garden plants but without direct evidence of impact, we answered unknown.
Imp-A4 (Weed status in anthropogenic systems)	c - high	0.4	Multiple garden sites and blogs recommend not using this plant because it is a prolific seed producer, produces large, strong clumps, and requires pruning (to remove seed heads before seeds mature), digging, thinning or herbicides to control (Garden NZ, 2012; Hegarty Webber, 2011; Kelly, 2011; RHS, 2013).
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	n - mod	0	This is a forest sedge and is spreading in wildlands along waterways (Burke Herbarium, 2012; Reznicek, 2002), but we found no evidence of interference in forest production. It is also reported to spread into pasture (Gatehouse, 2009 as cited by McDonald, 2010), but we found no evidence it reduces yield.
Imp-P2 (Lowers commodity value)	n - mod	0	We found no evidence.
Imp-P3 (Is it likely to impact trade)	n - high	0	New Zealand lists <i>Carex</i> species as harmful organisms (PCIT, 2012), restricting the importation of <i>Carex</i> plants.

Question ID	Answer - Uncertainty	Score	Notes (and references)
			Additionally, New Zealand has moved <i>C. pendula</i> to 'unwarranted pest' status and it is no longer legally offered for sale, trade, or propagation (NPPA, 2012). We found no evidence that <i>C. pendula</i> is a contaminant in trade, however, so we answered no with high uncertainty.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - mod	0	<i>Carex pendula</i> grows well in wet soils and has naturalized along waterways and ponds, in bogs, and in other areas with drainage (Seifert, 2008; McDonald, 2010; Kelly, 2011). Despite that, we found no evidence that this species impedes water movement or competes with other plants for water in production systems.
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	n - low	0	We found no direct evidence that this species is toxic. Only one genus in the Cyperaceae (<i>Scirpus</i>) is associated with animal toxicity, and no animal toxicity is associated with <i>Carex</i> (Burrows and Tyrl, 2001). In an archived Nibblers Discussion Forum, a sheep producer asked others if they had experienced toxicity from <i>C. pendula</i> ; all responses suggested looking for another culprit (Nibblers, 2007).
Imp-P6 (Weed status in production systems)	a - mod	0	We found no evidence that this species is considered a weed in production systems. Although this species "can spread into pasture and woody margins" (Gatehouse, 2009 as cited by McDonald, 2010), some <i>Carex</i> species are consumed as forage (Nibblers, 2007).
Geographic Potential			Unless otherwise indicated, all evidence in this risk element represents geo-referenced data with latitude and longitude points obtained from the Global Biodiversity Information Facility (GBIF, 2012).
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	We found no evidence it occurs here.
Geo-Z2 (Zone 2)	n - negl	N/A	We found no evidence it occurs here.
Geo-Z3 (Zone 3)	n - low	N/A	We found no evidence it occurs here.
Geo-Z4 (Zone 4)	n - low	N/A	We found no evidence it occurs here.
Geo-Z5 (Zone 5)	y - high	N/A	Reported in Armenia, Georgia, and Azerbaijan by Jiménez-Mejías and Luceño (Jiménez-Mejías and Luceño, 2011), but locations were not listed. Reported to survive low temperatures (-20 to -10°F) associated with Plant Hardiness Zone 5 (Stang, 2009). Hardy to Zones 5-9 (Cochrane, n.d.).
Geo-Z6 (Zone 6)	y - negl	N/A	The United States (IL, Basinger, 2001), Austria, Italy, Romania, and Sweden (1 point).
Geo-Z7 (Zone 7)	y - low	N/A	Germany, Luxembourg, Sweden, Norway, Denmark, Austria, Italy, Switzerland, and Belgium.
Geo-Z8 (Zone 8)	y - low	N/A	The United States (WA, King County; OR, Clackamas County).
Geo-Z9 (Zone 9)	y - low	N/A	The United States [OR, CA (Tehama and Butte Counties), VA (York)], Ireland, Northern Ireland, and Scotland.
Geo-Z10 (Zone 10)	y - mod	N/A	Portugal and Spain.
Geo-Z11 (Zone 11)	n - high	N/A	We found no evidence it occurs here.
Geo-Z12 (Zone 12)	n - high	N/A	We found a single point of occurrence in Cameroon (GBIF, 2012) but considered it to be erroneous.
Geo-Z13 (Zone 13)	n - low	N/A	We found no evidence it occurs here.
Köppen-Geiger Climate Classes			
Geo-C1 (Tropical rainforest)	n - mod	N/A	We found no evidence it occurs here.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-C2 (Tropical savanna)	n - mod	N/A	We found no evidence it occurs here.
Geo-C3 (Steppe)	y - mod	N/A	Spain, and a few points in Greece.
Geo-C4 (Desert)	n - low	N/A	Only reported from two locations in Spain.
Geo-C5 (Mediterranean)	y - negl	N/A	The United States [WA (King County), OR (Clackamas and Multnomah Counties), CA (Tehama and Butte Counties)], Morocco, Portugal, France, Italy (Islands), Spain, and Greece.
Geo-C6 (Humid subtropical)	y - low	N/A	The United States [VA (York County), IL (Jackson County)], Germany, Greece, and Italy (GBIF, 2012; Basinger, 2001).
Geo-C7 (Marine west coast)	y - negl	N/A	Canada (BC), Ireland, Northern Ireland, the United Kingdom, Norway, Germany, the Netherlands, Belgium, Spain, Luxembourg, Australia, and New Zealand.
Geo-C8 (Humid cont. warm sum.)	y - high	N/A	Reported in Albania, Armenia, Azerbaijan, Georgia, Bosnia-Herzegovina, Crimea, and Ukraine by Jiménez-Mejías and Luceño (Jiménez-Mejías and Luceño, 2011), but locations in these countries were not listed.
Geo-C9 (Humid cont. cool sum.)	y - low	N/A	France, Germany, Poland, Austria, Denmark, Sweden, and Greece.
Geo-C10 (Subarctic)	y - high	N/A	France, Germany, and Romania.
Geo-C11 (Tundra)	n - high	N/A	Data points in tundra from France, Switzerland, Austria, and Liechtenstein, but plant only reported from coastal areas of Scandinavia, not in northern area with tundra. Not reported in Plant Hardiness Zones 4 or below.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence it occurs here.
10-inch Precipitation Bands			
Geo-R1 (0-10 inches; 0-25 cm)	y - high	N/A	Southeast coastal area and desert area of Spain. Because <i>C. pendula</i> is generally regarded as a water-loving species, it is likely restricted to riparian areas in this precipitation band.
Geo-R2 (10-20 inches; 25-51 cm)	y - low	N/A	The United Kingdom, Spain, and Australia.
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	The United States (CA, Butte County), the United Kingdom, Greece, Australia, New Zealand, Romania, Spain, Morocco, and Italy.
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	The United States (CA, Tehama County), Ireland, Northern Ireland, Greece, Portugal, and New Zealand.
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	The United States (OR, Multnomah and Clackamas Counties; VA, York County; IL, Jackson County), the United Kingdom, Spain, and New Zealand.
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	The United States (WA, King County), Ireland, Northern Ireland, and Spain.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	Canada (BC), The United States (WA, King County), the United Kingdom, and New Zealand.
Geo-R8 (70-80 inches; 178-203 cm)	y - low	N/A	The United Kingdom.
Geo-R9 (80-90 inches; 203-229 cm)	y - low	N/A	The United Kingdom.
Geo-R10 (90-100 inches; 229-254 cm)	y - low	N/A	The United Kingdom.
Geo-R11 (100+ inches; 254+ cm)	n - high	N/A	We found no evidence it occurs here.
Entry Potential			
Ent-1 (Plant already here)	y - negl	1	<i>Carex pendula</i> already occurs in the United States in the following locations (Weakley, 2010; Swearingen, 2011; Dean

Weed Risk Assessment for *Carex pendula*

Question ID	Answer - Uncertainty	Score	Notes (and references)
			et al., 2008; Burke Herbarium, 2012; USDA NRCS, 2012; Basinger, 2001). <i>Carex pendula</i> was originally planted but is now escaping and naturalized along an intermittent drainage in Thompson Woods on the Southern Illinois University campus (Jackson County, IL; Basinger, 2001).
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	