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Version 1



Weed Risk Assessment for *Phyllostachys aurea* Carr. ex A. & C. Rivière (Poaceae) – Golden bamboo



Phyllostachys aurea (source: Chuck Barger, University of Georgia, invasives.org).

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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 “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 model¹—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 our 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 any area within it. We use a climate matching tool in our WRAs to evaluate those areas of the United States that are suitable for the establishment of the plant. We also use a Monte Carlo simulation to evaluate the consequences of uncertainty on the outcome of the risk assessment. For more information on the PPQ WRA process, please refer to the document, *Introduction to the PPQ Weed Risk Assessment Process*, which is available upon request.

***Phyllostachys aurea* Carr. ex A. & C. Rivière – golden bamboo**

Species Family: Poaceae

Information Initiation: In an email dated February 21, 2012, Marilyn Jordan, from The Nature Conservancy in Long Island, New York, asked the PERAL Weed Team to analyze *Phyllostachys aureosulcata*, a common and problematic running bamboo present in Long Island. She asked that we compare the results from the PPQ WRA with those of the New York State (NYS) weed risk analysis system (Jordan, 2012). While assessing *P. aureosulcata*, we learned that it is often confused with its congener, *P. aurea*, which is also problematic. We decided to assess both species simultaneously. This is the assessment of *P. aurea*.

Foreign distribution: Native to China and Japan (Weakley, 2010). Established in Taiwan, Australia, New Zealand, Mexico, Ecuador, Honduras, Costa Rica, Brazil, Argentina, Bolivia, Spain, the United Kingdom (GBIF, 2012), and Madagascar (Kull et al., 2012).

U.S. distribution and status: *Phyllostachys aurea* is probably the first species of bamboo successfully introduced into the United States (1882 in Montgomery, AL) (Young and Haun, 1961). It is established in the mid-Atlantic region (Sarver et al., 2008; Weakley, 2010), throughout the southeastern United States from MD south to FL, west to LA and AR, and northwest to OR (Smith, 2008) and CA (Hrusa et al., 2002). It is listed as naturalized in CA (Hrusa et al., 2002), invasive or potentially invasive in HI (Staples et al., 2002), and invasive in PA, MD, VA, WV, and GA (EDDMaps, 2012). It is considered naturalized or invasive in 273 counties in the United States (Swearingen, 2011).

WRA area: Entire United States, including territories.

¹ Koop, A., L. Fowler, L. Newton, and B. Caton. 2012. Development and validation of a weed screening tool for the United States. *Biological Invasions* 14(2):273-294. DOI:10.1007/s10530-011-0061-4

1. *Phyllostachys aurea* analysis

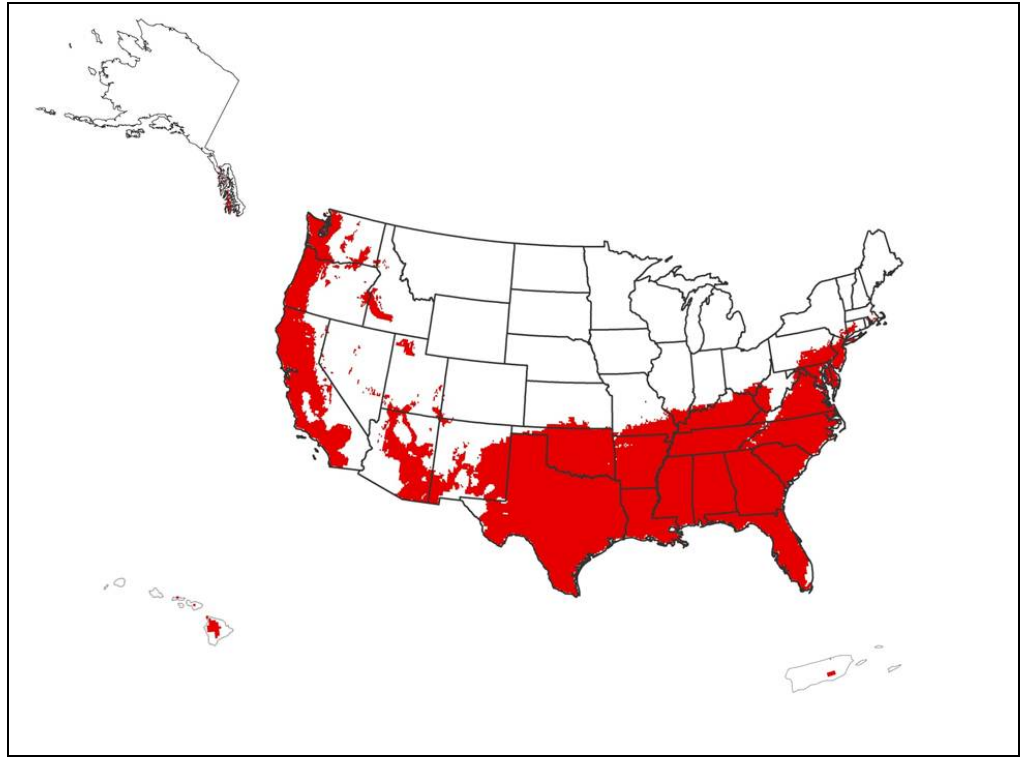
Establishment/Spread Potential *Phyllostachys aurea* is widely distributed and has naturalized or become invasive in several areas (e.g., Mulvaney, 1991; Sarver et al., 2008). It flowers every 7 to 12 years (Miller, 2003), but seed production is rarely observed (Gucker, 2009). This running bamboo spreads primarily via underground rhizomes, which send up new shoots each spring (Gucker, 2009) and quickly form dense thickets (Smith, 2008; Swearingen, 2011). Rhizomes can be transported, such as in yard waste (Langeland and Stocker, 2001). Infestations may rapidly expand after disturbance (Miller, 2003), including fires because rhizomes are protected deep underground (Gucker, 2009). This element had a low level of uncertainty.
Risk score = 8 Uncertainty index = 0.06

Impact Potential *Phyllostachys aurea* impacts both natural and anthropogenic systems. It invades secondary forests, forest clearings, and forest edges in a number of introduced areas (Gucker, 2009), and displaces native species (Kaufman and Kaufman, 2007; Swearingen, 2011). Leaf litter of *P. aurea* along streams changes ecosystem processes by altering stream food webs beginning with litter-feeding stream invertebrates (Gonzalez and Christoffersen, 2006; LBJWC, 2007). It is targeted for eradication in New Zealand (Veitch and Clout, 2002), declared noxious in Australia (Groves et al., 2005), and otherwise controlled in a number of natural areas (Langeland and Stocker, 2001). In urban settings, this bamboo has been known to buckle sidewalks and driveways (Invasive.org, 2012), and invade beachfronts (Batianoff and Franks, 1997). Because of aggressive spread through underground rhizomes, it rarely remains contained within planting boundaries (Smith, 2008). Where neglected in gardens, it is difficult to control (Forest Floor, 2011), and an established stand can take several years of hard work to completely eradicate (Smith, 2008). We found little information on its behavior in agricultural settings. One report lists it as an agricultural weed in Australia, but with no details (Randall, 2007). This risk element had an average level of uncertainty.
Risk score = 3.2 Uncertainty index = 0.15

Geographic Potential We estimate that about 33 percent of the United States is suitable for the establishment of *Phyllostachys aurea* (Fig. 1). The 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 *Phyllostachys aurea* represents the joint distribution of Plant Hardiness Zones 6-12, areas with 10-100+ inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical savannah, steppe, mediterranean, humid subtropical, marine west coast, and humid continental warm summer.

Entry Potential *Phyllostachys aurea* is widely established in the United States (see U.S. distribution and status, above). For this reason, we did not assess this risk element.

Figure 1. Predicted distribution of *Phyllostachys aurea* 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) = 0.420
 P(Minor Invader) = 0.540
 P(Non-Invader) = 0.040

Risk Result = High Risk

Secondary Screening = Not Applicable

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

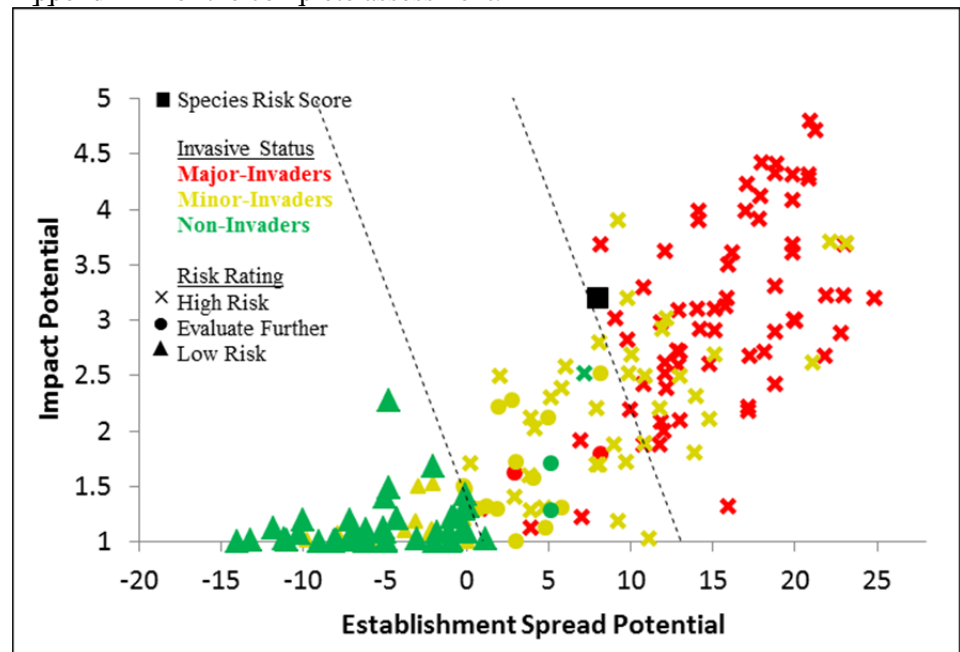
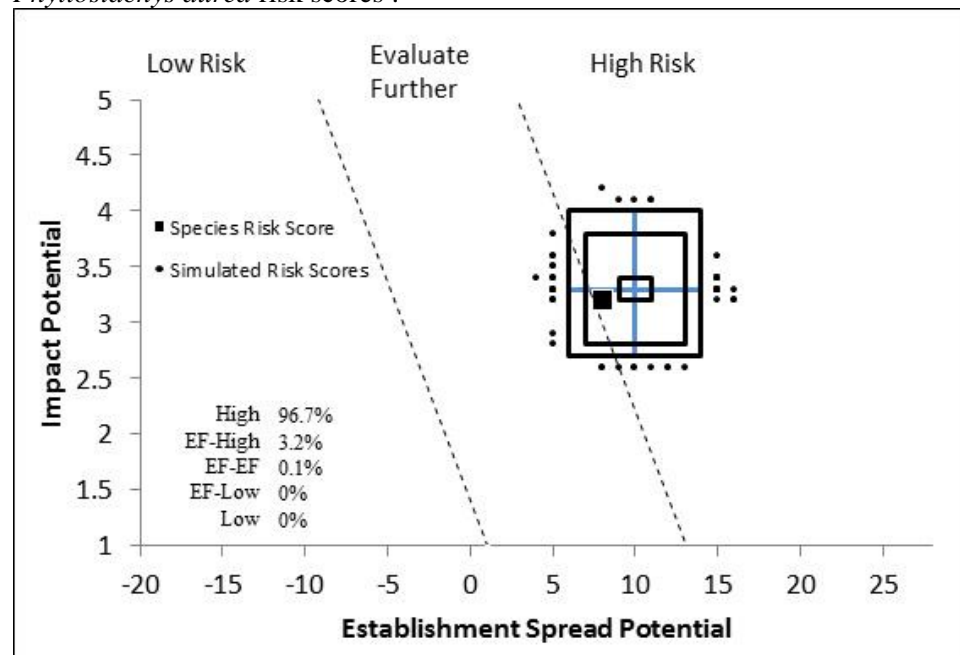


Figure 3. Monte Carlo simulation results (N=5000) for uncertainty around *Phyllostachys aurea* risk scores^a.



^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 *Phyllostachys aurea* is High Risk (Fig. 2). In our uncertainty analysis (i.e., the Monte Carlo simulation), almost all (99.9 percent) of the iterations, including those that underwent secondary screening, resulted in an outcome of High Risk (Fig. 3).

Phyllostachys aurea produces new culms (stems) each spring, after which new branch rhizomes develop. In a well-established colony of running bamboo, these rhizomes may sometimes extend 15 to 25 feet underground before the end of the season (Young and Haun, 1961). Under favorable conditions rhizomes branch in all directions (Young and Haun, 1961). This makes running bamboos, including *P. aurea*, difficult to control in gardens and urban plantings. Without containment, *P. aurea* will spread to form a dense monoculture. All of the hardy running bamboos (the largest of which are within the genus *Phyllostachys*) begin by forming a more or less open thicket; given enough time and space, these species will eventually form a forest (Young and Haun, 1961). The dense shade and thick leaf layer in the interior of a stand prohibits the growth of other species (Sarver et al., 2008). In natural areas, this behavior changes native community structure and composition (Kaufman and Kaufman, 2007; SCEPPC, 2008; Swearingen, 2011), ultimately threatening areas set aside for conservation.

Some confusion over the identity of running bamboos has existed, particularly between *P. aurea* and *P. aureosulcata* in northern states. For example, a bamboo species naturalized in Illinois was originally reported as being *P. aurea* (Basinger, 1999) and later corrected to *P. aureosulcata* (Basinger, 2001). A number of towns in New York (particularly on Long Island) and Pennsylvania have established or are considering ordinances to regulate the planting and growth of running bamboos in general (Brookhaven NY, 2012; Haverford PA, 2011; Jordan, 2012; West Bradford PA, 2011). *Phyllostachys aurea* is somewhat less cold-tolerant than *P. aureosulcata* and is likely to be limited in its northern expansion by winter cold temperatures. Otherwise, they present a similar risk and managing these species similarly may be prudent.

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Appendix A. Weed risk assessment for *Phyllostachys aurea* Carr. ex A. & C. Rivière (Poaceae). The following information was obtained from the species' risk assessment which was conducted on a Microsoft Excel platform. The information shown below 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 (Invasiveness elsewhere)	f - negl	5	Listed as invasive in Australia (Randall, 2007), specifically in the southeastern bushlands (Mulvaney, 1991). It is targeted for eradication on Raoul Island in New Zealand (Veitch and Clout, 2002). It is listed as naturalized or invasive in 273 counties in the United States (Swearingen, 2011). Specifically, it is listed as invasive in Hawaii (Staples et al., 2002, in the mid-Atlantic region of the United States (Sarver et al., 2008), in Pennsylvania, Maryland, Virginia, West Virginia, and Georgia, including two national parks (in VA and WV) (EDDMaps, 2012). It has naturalized in the Australian Capital Territory (Groves et al., 2005), is fully naturalized in New Zealand (Howell and Sawyer, 2006), Corsica and Spain (DAISIE, 2009), and Madagascar (Kull et al., 2012). It is naturalizing in the southeast, forming dense stands (Weakley, 2010), and is listed and described as a moderate threat in North Carolina ("the most commonly cultivated species that is naturalizing is <i>P. aurea</i> " (Smith, 2008). Alternate answers for the Monte Carlo simulation are both e.
ES-2 (Domesticated to reduce weed potential)	n - low	0	This species is widely promoted and sold as an ornamental (Smith, 2008) but there is no evidence that it has been domesticated in a way that reduces its weed potential.
ES-3 (Weedy congeners)	y - negl	1	<i>Phyllostachys pubescens</i> was introduced from China into Japan in 1746. It is a clonal grass, growing 25 m high, capable of overtopping and killing a big tree; it has come to dominate the hundreds of kilometers of abandoned terrace cultivation that fringe the bases of the mountains and its upward spread is a continuing threat to the ancient woodlands above the terraces (Rackham, 2008). <i>Phyllostachys pubescens</i> has invaded forests in Japan, forming uniform monolayers of foliage (monoculture), and dominating competing vegetation; between 1975 and 1993, this bamboo had replaced the trees in a once-mixed forest (Isagi and Torii, 1977). <i>Phyllostachys flexuosa</i> is reported to form dense stands which prevent native vegetation from growing (GISD, 2008). <i>Phyllostachys nigra</i> and <i>P. heterocycla</i> are listed in Australia as Category 5 weeds (Randall, 2007) and <i>P. mitis</i> is a principal weed in New Zealand (Holm et al., 1979).
ES-4 (Shade Tolerance)	n - low	0	Thrives in full sun but is also able to grow and spread in sparsely wooded forests (Smith, 2008). Full sun (DavesGarden, 2012). Thrives in full sun but can tolerate moderate shade (Forest Floor, 2011).
ES-5 (Climbing or smothering growth form)	n - negl	0	<i>Phyllostachys aurea</i> is a woody, perennial, reed-like plant that can reach heights up to 30 feet (Smith, 2008).
ES-6 (Dense Thickets)	y - negl	2	<i>Phyllostachys aurea</i> infestations rapidly spread through rhizomes, often forming dense, monotypic thickets (Smith, 2008). This bamboo can form dense monocultures that displace native species (Swearingen, 2011). They (<i>P. aurea</i> and others) will take over any sunny or semi-shaded area forming impenetrable thickets and effectively crowding out all native vegetation (Reaves, 2011).

			Running bamboos spread primarily by rhizomes; new culms usually appear above ground in mid-spring at varying space levels; the giant species eventually form a forest (Young and Haun, 1961).
ES-7 (Aquatic)	n - negl	0	Terrestrial plant (DAISIE, 2009). Spreads most rapidly in moist soils (Smith, 2008).
ES-8 (Grass)	y - negl	1	<i>Phyllostachys aurea</i> is a member of the grass family, Poaceae (Smith, 2008).
ES-9 (N ₂ -fixer)	? - max		Studies from China have shown associative N-fixation in two congeners, <i>Phyllostachys pubescens</i> and <i>P. meyeri</i> (Gu and Wu, 1994, 1998). Nitrogen-fixing plants fall into three categories, rhizobial, actinorhizal, and associative (Thompson, 2004); associative N-fixation is well-demonstrated in rice and several grasses (e.g., sugarcane, forage grasses) within the family Poaceae (Thompson, 2004). Because the N-fixing <i>Phyllostachys</i> spp. are reported from only one geographic location, and because these are the only reported cases of N-fixation in bamboo (Thompson, 2004), answering 'unknown' with maximum uncertainty.
ES-10 (Viable seeds)	y - negl	1	Although this bamboo is capable of reproducing by seed, the rarity of flowering in the United States makes sexual reproduction unlikely (Gucker, 2009). Delayed seed production has evolved in bamboos to escape seed predation (Janzen, 1974). <i>Phyllostachys aurea</i> is reported to flower every 7-12 years (Miller, 2003) or every 28-29 years (in Europe and England) (Janzen, 1974). Rarely produces flowers and fruit (Smith, 2008). Not known to flower in the southeastern United States. (Weakley, 2010). Invasive spread of bamboo by seed is unlikely but cannot be ruled out completely (Lowenstein and Enloe, n.d.) <i>Phyllostachys aurea</i> rarely flowers - it may not flower for several decades - but when it does it produces flower spikelets containing 8 to 12 flowers; its main form of reproduction is through rhizomes that spread from the parent plant and produce abundant new above ground shoots (DOD, 2009).
ES-11 (Self-compatible)	n - mod	-1	Evidence suggests that flowers are cross-pollinated, suggesting that isolated clones may produce little or no seed (Gucker, 2009; Janzen, 1974). Studies of the congener <i>P. nidularia</i> suggest that honey bee visits to flowering bamboo may assist wind-pollination (Huang et al., 2002).
ES-12 (Special Pollinators)	n - negl	0	Bamboos are wind-pollinated (Gucker, 2009).
ES-13 (Min generation time)	b - low	1	Most reproduction is vegetative through the expansion of rhizomes (Gucker, 2009) and new shoots emerge each spring (Gucker, 2009). Although bamboos can produce seeds, they appear to do so very rarely, particularly in introduced areas (Smith, 2008; Weakley, 2010). <i>Phyllostachys aurea</i> is said to flower every 7 to 12 years (Miller, 2003). Alternate answers for the Monte Carlo simulation are both c.
ES-14 (Prolific reproduction)	n - low	-1	Seeds very rarely (every 7-12 years) (Miller, 2003). See discussion under ES-10.
ES-15 (Unintentional dispersal)	y - low	1	Can become established by dumping of yard waste containing rhizome fragments (Langeland and Stocker, 2001).
ES-16 (Trade contaminant)	n - negl	-1	<i>Phyllostachys aurea</i> rarely flowers and there is no evidence that seeds have been dispersed as trade contaminates or hitchhikers. Additionally, plant rhizomes of these large woody species are not likely to disperse as contaminates or hitchhikers.
ES-17 (#Natural dispersal vectors)	0 -	-4	Information relevant for ES17a through ES17e: The general opinion about mast-flowering bamboos (which includes the genus

			<i>Phyllostachys</i>) is that they experience infrequent, cyclical flowering with short-lived seed that is not adapted for dispersal by any agent (Stapleton et al., 2004). Most mast-flowering bamboos have passive dispersal, concentrating seedling recruitment near the dead skeleton of the parent plant (Keeley and Bond, 1999).
ES-17a (Wind dispersal)	n - negl		Most mast-flowering bamboos have passive dispersal, concentrating seedling recruitment near the dead skeleton of the parent plant (Keeley and Bond, 1999).
ES-17b (Water dispersal)	? - max		There is the potential for dispersal of bamboo by rhizome fragments along riparian corridors (Ward, 2011).
ES-17c (Bird dispersal)	n - low		Most mast-flowering bamboos have passive dispersal, concentrating seedling recruitment near the dead skeleton of the parent plant (Keeley and Bond, 1999).
ES-17d (Animal external dispersal)	n - low		Most mast-flowering bamboos have passive dispersal, concentrating seedling recruitment near the dead skeleton of the parent plant (Keeley and Bond, 1999).
ES-17e (Animal internal dispersal)	n - low		There is a possibility that giant pandas, whose main food source is bamboo, may disperse seed (Bies, 2002). Although the seeds of many herbaceous plants, including grasses, can pass through the guts of large herbivores consuming the seeds along with foliage (Janzen, 1984), the general opinion about bamboos is that they experience infrequent, cyclical flowering with short-lived seed that is not adapted for dispersal by any agent (Stapleton et al., 2004). Most mast-flowering bamboos have passive dispersal, concentrating seedling recruitment near the dead skeleton of the parent plant (Keeley and Bond, 1999).
ES-18 (Seed bank)	n - low	-1	Seed production in <i>P. aurea</i> is rare (see ES-10); it is believed that viability is lost over time and that golden bamboo seeds lack any long-term dormancy (Gucker, 2009; Janzen, 1974). Seed viability in the congener <i>P. pubescens</i> is completely lost after one year (Guangcho, 2002).
ES-19 (Tolerance to loss of biomass)	y - negl	1	Colonizes by rhizomes with infestations rapidly expanding after disturbance (Miller, 2003). In Georgia, <i>P. aurea</i> stands have been burned after having the stems cut and left on site; in the burned area, golden bamboo sprouted and recolonized the site (Gucker, 2009).
ES-20 (Herbicide resistance)	n - low	0	Large infestations of <i>P. aurea</i> can be killed by thoroughly wetting the foliage with a 2% solution of glyphosate and a 0.5% nonionic surfactant; large plants can be killed by cutting them down near the ground and spraying the freshly cut stump with a 25% solution of glyphosate (Smith, 2008). Control with foliar application of 3% Roundup Pro or application of 5% Roundup Pro to cut culms; results not consistent (Langeland and Stocker, 2001). In a greenhouse study, application of various herbicides reduced populations, but none provided 100% control (Czarnota and Derr, 2007).
ES-21 (# Cold hardiness zones)	7	0	
ES-22 (# Climate types)	6	2	
ES-23 (# Precipitation bands)	10	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	? - max		Field observations and subsequent laboratory research of a congener, <i>P. edulis</i> , in Taiwan suggest that allelopathy may play an

			important role in interspecific competition (Chou and Yang, 1982). Dense shade and possible allelopathic effects allow little if anything to grow beneath bamboo (Lowenstein and Enloe, n.d.).
Imp-G2 (Parasitic)	n - negl	0	<i>Phyllostachys aurea</i> is a tall, woody bamboo species within the family Poaceae. No species within the family Poaceae are known to be parasitic (Nickrent, 2012).
Impacts to Natural Systems			
Imp-N1 (Ecosystem processes)	y - mod	0.4	Largely undocumented; however, a number of websites state that for streams, <i>P. aurea</i> leaf litter alters stream food webs starting with litter-feeding stream invertebrates (Gonzalez and Christoffersen, 2006; LBJWC, 2007).
Imp-N2 (Community structure)	y - mod	0.2	<i>Phyllostachys aurea</i> is known to have the potential to significantly alter the structure of the native vegetation (Veitch and Clout, 2002). Running bamboos, including <i>P. aurea</i> , spread by rhizomes and eventually form a forest (Young and Haun, 1961).
Imp-N3 (Community composition)	y - negl	0.2	Suppresses the growth of native plants (Kaufman and Kaufman, 2007). <i>Phyllostachys aurea</i> can form dense, monocultural thickets that displace native species (Swearingen, 2011). The dense shade and thick leaf layer in the interior of a stand prohibits the growth of other species (Sarver et al., 2008). Known to have the potential to significantly alter the composition of the native vegetation (Veitch and Clout, 2002).
Imp-N4 (T&E species)	y - low	0.1	See Imp-N5.
Imp-N5 (Globally outstanding ecoregions)	y - low	0.1	<i>Phyllostachys aurea</i> has invaded secondary forests, forest clearings and forest edges in Texas, is spreading vegetatively from roadsides into hammock/pine-oak forests in Georgia, and occurs in the Piedmont and the Coastal Plain in South Carolina (Gucker, 2009). It has naturalized in Hawaii and has formed a monoculture excluding other plant species (Staples et al., 2002). Because much of Hawaii and the southeastern United States are considered globally outstanding ecoregions, answering 'yes' with low uncertainty.
Imp-N6 (Natural systems weed)	c - negl	0.6	Targeted for eradication on Raoul Island in New Zealand (Veitch and Clout, 2002). Declared noxious in New South Wales and western Australia; classified as an environmental weed; naturalized and known to be a minor problem warranting control at 4 or more locations within a state or territory; prohibited from sale in New South Wales (Groves et al., 2005). Not a common problem but once established can spread extensively; populations should be controlled immediately (Langeland and Stocker, 2001). Alternate answers for the Monte Carlo simulation are both b.
Impact to Anthropogenic areas (cities, suburbs, roadways)			
Imp-A1 (Affects property, civilization, ...)	y - low	0.1	"Planted but soon regretted. Wide-creeping rootstocks form impenetrable solid stands. 'Roots of steel' can buckle sidewalks and driveways" (J.R. Allison, Invasive.org, 2012).
Imp-A2 (Recreational use)	? - max		Although there is no evidence to support a "yes" for this question, it may be possible to reduce the recreational use of an area. For example, this naturalized exotic rarely (but occasionally) invades sandy beachfronts in Queensland, Australia (Batianoff and Franks, 1997) and it has invaded two national parks in the eastern United States, one in Virginia and one in West Virginia (EDDMaps, 2012).
Imp-A3 (Affects ornamental plants)	y - negl	0.1	A popular garden website has a few negative comments, all from gardeners having to combat this bamboo in their yards - said to "take a lot of your time to keep it in check" (DavesGarden, 2012). This bamboo spreads rapidly via rhizome production and will form

			tall monocultures that shade out all other vegetation. Rapidly running on loose soil, this bamboo has a reputation as an invasive and difficult to control plant in suburban gardens where neglected (Forest Floor, 2011).
Imp-A4 (Anthropogenic weed)	c - negl	0.4	Recorded as having escaped from cultivation in Australia (Randall, 2007). "This plant should be avoided at all costs since it rarely remains contained within desirable boundaries; an established stand can take several years of hard work to completely eradicate" (Smith, 2008). Alternate answers for the Monte Carlo simulation are both b.
Impact to Production systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Crop yield)	n - mod	0	No evidence.
Imp-P2 (Commodity Value)	n - mod	0	No evidence.
Imp-P3 (Affects trade)	n - mod	0	No evidence.
Imp-P4 (Irrigation)	n - mod	0	No evidence.
Imp-P5 (Animal toxicity)	n - low	0	<i>Phyllostachys aurea</i> , along with other bamboo species, serves as the primary food source for pandas in its native range (Bies, 2002). Its congener, <i>P. aureosulcata</i> , along with many other <i>Phyllostachys</i> species, have been tested and found to be of suitable nutritive value as browse for livestock (Halvorson et al., 2010).
Imp-P6 (Production system weed)	a - mod	0	Recorded as a weed of agriculture in Australia (Randall, 2007), however, there is very little information suggesting that this is a weed of agriculture and no specific details could be found in the literature. Alternate answers for the Monte Carlo simulation are both b.
GEOGRAPHIC POTENTIAL			
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	Tolerates temperatures as low as 0°F (-18°C) (Gucker, 2009)
Geo-Z2 (Zone 2)	n - negl	N/A	Tolerates temperatures as low as 0°F (-18°C) (Gucker, 2009)
Geo-Z3 (Zone 3)	n - negl	N/A	Tolerates temperatures as low as 0°F (-18°C) (Gucker, 2009)
Geo-Z4 (Zone 4)	n - negl	N/A	Tolerates temperatures as low as 0°F (-18°C) (Gucker, 2009)
Geo-Z5 (Zone 5)	n - low	N/A	Tolerates temperatures as low as 0°F (-18°C) (Gucker, 2009)
Geo-Z6 (Zone 6)	y - low	N/A	Zones 6-11 (Dave's Garden 2012); tolerates temperatures as low as 0°F (-18°C) (Gucker, 2009)
Geo-Z7 (Zone 7)	y - negl	N/A	USA (southeast, into VA), Japan (p.s. GBIF, 2012). Tolerates winter temperatures to 0°F (-18°C) (Kaufman and Kaufman, 2007; Young and Haun, 1961).
Geo-Z8 (Zone 8)	y - negl	N/A	USA (southern states), Bolivia, Spain (p.s. GBIF, 2012).
Geo-Z9 (Zone 9)	y - negl	N/A	Canada (British Columbia), USA (southern states), Mexico, Spain, New Zealand (p.s. GBIF, 2012).
Geo-Z10 (Zone 10)	y - negl	N/A	USA (CA, FL), Mexico, Argentina, Australia, New Zealand, Taiwan (p.s. GBIF, 2012).
Geo-Z11 (Zone 11)	y - negl	N/A	Honduras, Brazil (p.s. GBIF, 2012).
Geo-Z12 (Zone 12)	y - low	N/A	Costa Rica, Ecuador (p.s. GBIF, 2012).
Geo-Z13 (Zone 13)	n - low	N/A	No evidence.
Koppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - low	N/A	No evidence.
Geo-C2 (Tropical savanna)	y - negl	N/A	Honduras, Costa Rica (p.s. GBIF, 2012).
Geo-C3 (Steppe)	y - mod	N/A	Spain (p.s. GBIF, 2012).
Geo-C4 (Desert)	n - low	N/A	No evidence. (Note: There is a point in GBIF, however, upon further investigation, this is an herbarium specimen.)

Geo-C5 (Mediterranean)	y - negl	N/A	California, Spain (p.s.GBIF, 2012).
Geo-C6 (Humid subtropical)	y - negl	N/A	USA (southern states, eastern seaboard), Brazil, Argentina, Australia, Japan, Taiwan (p.s. GBIF, 2012).
Geo-C7 (Marine west coast)	y - negl	N/A	Canada (British Columbia), Mexico, Ecuador, Bolivia, UK, Spain, New Zealand (p.s. GBIF, 2012).
Geo-C8 (Humid cont. warm sum.)	y - low	N/A	USA (DE [occ. EDDMaps, 2012], CT [occ. CTIPC, 2011], PA [West Bradford PA, 2011]).
Geo-C9 (Humid cont. cool sum.)	n - low	N/A	No evidence.
Geo-C10 (Subarctic)	n - negl	N/A	Too cold based on low temperature tolerance (Gucker, 2009).
Geo-C11 (Tundra)	n - negl	N/A	Too cold based on low temperature tolerance (Gucker, 2009).
Geo-C12 (Icecap)	n - negl	N/A	Too cold based on low temperature tolerance (Gucker, 2009).
10-inch precipitation bands			
Geo-R1 (0-10")	n - low	N/A	No evidence.
Geo-R2 (10-20")	y - negl	N/A	USA (CA), Spain (p.s. GBIF, 2012).
Geo-R3 (20-30")	y - negl	N/A	USA (CA, southern states), UK, Spain (p.s. GBIF, 2012).
Geo-R4 (30-40")	y - negl	N/A	USA (southern states), Mexico, Argentina, Spain, Australia (p.s. GBIF, 2012).
Geo-R5 (40-50")	y - negl	N/A	USA (southern states, east coast), Australia, New Zealand (p.s. GBIF, 2012).
Geo-R6 (50-60")	y - negl	N/A	USA (southern states), New Zealand (p.s. GBIF, 2012).
Geo-R7 (60-70")	y - negl	N/A	Canada (British Columbia), USA (LA), Honduras, Brazil, New Zealand, Japan (p.s.GBIF, 2012).
Geo-R8 (70-80")	y - negl	N/A	New Zealand, Japan (p.s. GBIF, 2012).
Geo-R9 (80-90")	y - negl	N/A	Ecuador, Taiwan (p.s. GBIF, 2012).
Geo-R10 (90-100")	y - low	N/A	Present in areas with 80-90 and 100+ inches.
Geo-R11 (100"+)	y - low	N/A	Costa Rica (p.s. GBIF, 2012).
ENTRY POTENTIAL			
Ent-1 (Already here)	y - negl	1	Probably the first species of bamboo successfully introduced into the United States (1882 in Montgomery, AL) (Young and Haun 1961). Found throughout the SE United States from MD south to FL, west to LA and AR, and northwest to OR (Smith 2008). Found in the mid-Atlantic region of the U.S. (Sarver 2008). Listed as growing (naturalized) in California (Hrusa et al., 2002). Listed as invasive or potentially invasive in HI (Staples et al., 2002). Reported as invasive in PA, MD, VA, WV, GA (EDDMaps, 2012). Listed as naturalized or invasive in 273 counties in the United States (Swearingen, 2011). In DE, NC, SC, VA (Weakley, 2010).
Ent-2 (Proposed for entry)	-	N/A	
Ent-3 (Human value & cultivation/trade status)	-	N/A	
Ent-4 (Entry as a Contaminant)			
Ent-4a (In MX, CA, Central Amer., Carib., or China)	-	N/A	
Ent-4b (Propagative material)	-	N/A	
Ent-4c (Seeds)	-	N/A	
Ent-4d (Ballast water)	-	N/A	
Ent-4e (Aquaria)	-	N/A	
Ent-4f (Landscape products)	-	N/A	
Ent-4g (Container, packing, trade goods)	-	N/A	

Weed Risk Assessment for *Phyllostachys aurea*

Ent-4h (Commodities for consumption)	-	N/A
Ent-4i (Other pathway)	-	N/A
Ent-5 (Natural dispersal)	-	N/A