

<i>Paulownia tomentosa</i> (Princess tree, empress tree, royal paulownia)		Answer	Score
1.01	Is the species highly domesticated?	n	0
1.02	Has the species become naturalised where grown?		
1.03	Does the species have weedy races?		
2.01	Species suited to FL climates (USDA hardiness zones; 0-low, 1-intermediate, 2-high)	2	
2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	
2.03	Broad climate suitability (environmental versatility)	y	1
2.04	Native or naturalized in regions with an average of 11-60 inches of annual precipitation	y	1
2.05	Does the species have a history of repeated introductions outside its natural range?	y	
3.01	Naturalized beyond native range	y	2
3.02	Garden/amenity/disturbance weed	y	2
3.03	Weed of agriculture	n	0
3.04	Environmental weed	y	4
3.05	Congeneric weed	n	0
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	n	0
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals	n	-1
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens	?	
4.07	Causes allergies or is otherwise toxic to humans	n	0
4.08	Creates a fire hazard in natural ecosystems	n	0
4.09	Is a shade tolerant plant at some stage of its life cycle	n	0
4.10	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils). North & Central Zones: infertile soils; South Zone: shallow limerock or Histisols.	y	1
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	n	0
5.01	Aquatic	n	0
5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte	n	0
6.01	Evidence of substantial reproductive failure in native habitat	n	0
6.02	Produces viable seed	y	1
6.03	Hybridizes naturally	n	-1
6.04	Self-compatible or apomictic	y	1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	y	1
6.07	Minimum generative time (years)	3	0

7.01	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y	1
7.02	Propagules dispersed intentionally by people	y	1
7.03	Propagules likely to disperse as a produce contaminant	n	-1
7.04	Propagules adapted to wind dispersal	y	1
7.05	Propagules water dispersed	y	1
7.06	Propagules bird dispersed	n	-1
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)	n	-1
8.01	Prolific seed production	y	1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	y	1
8.03	Well controlled by herbicides	y	-1
8.04	Tolerates, or benefits from, mutilation or cultivation	y	1
8.05	Effective natural enemies present in U.S.		
	Total Score		14
	Implemented Pacific Second Screening		No
	Risk Assessment Results		Reject

	Reference	Source data
1.01		Cultivated, but no evidence of selection for reduced weediness.
1.02		Skip to 2.01
1.03		Skip to 2.01
2.01	<p>1. PERAL NAPPFAST Global Plant Hardiness (http://www.nappfast.org/Plant_hardiness/NAPPFAST%20Global%20zones/10-year%20climate/PLANT_HARDINESS_10YR%20lgnd.tif). 2. USDA/ARS-GRIN [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?405679 [1/20/2010]. 3.a-b. Innes, Robin J. 2009. <i>Paulowina tomentosa</i>. In: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/databasefeis/ [1/22/2010]. 4. Hao Zheng et al. Invasive Plants of Asian Origin Established in the United States and Their Natural Enemies: <i>Paulownia tomentosa</i>, Princess Tree, USDA Forest Service, FHTET-04-05. http://www.invasive.org/weeds/asian/paulownia.pdf [1/20/2010]. 5. Flora of China. http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200020800 [1/22/2010]. 6. Southeast Exotic Pest Plant Council Invasive Plant Manual. 7. Missouri Botanical Garden, Kemper Center for Home Gardening. 8. Ohwi, J. (1965) <i>Flora of Japan (Engl. ed.)</i> National Science Museum, Tokyo, Japan. Eds. Meyer, F.G. & Walker, E.H. Smithsonian Institute, Washington D.C.</p>	<p>No computer analysis was performed. 1. Global plant hardiness zones 8-11. 2. Native to Asia-Temperate: China. 3.a. Native to eastern and central China, where it occurs south of the 32°F (0°C) isotherm. 3.b. Cold climates may limit establishment and spread; USDA hardiness zones 7-10, where average temperatures range from 0°-40°F (-18°-4°C) are considered most favorable. 4. Occurs naturally at elevations below 1800 m in Henan, Hubei, Shaanxi, and probably northern Sichuan (China). 5. Cultivated or wild; below 1800 m. Anhui, Gansu, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, S Liaoning, Shaanxi, Shandong, Shanxi, N Sichuan [cultivated in North America, Europe, Japan, and Korea]. 6. Native to western and central China; USDA hardiness zones 7-10 are most favorable. 7. USDA hardiness zones 5-8. 8. Much cultivated in our area and reportedly wild in Kyushu (Japan).</p>
2.02		No computer analysis was performed. Native range is well known; refer to 2.01 source data.

2.03	<p>1. Köppen-Geiger climate map (http://www.hydrol-earth-syst-sci.net/11/1633/2007/hess-11-1633-2007.pdf). 2. USDA/ARS-GRIN [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?405679 [2010, January 20]. 3.a-b. Innes, Robin J. 2009. <i>Paulowina tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 4. Hao Zheng, Yun Wu, Jianqing Ding, Denise Binion, Weidong Fu and Richard Reardon, Invasive Plants of Asian Origin Established in the United States and Their Natural Enemies: <i>Paulownia tomentosa</i> , Princess Tree, USDA Forest Service, FHTET-2004-05. http://www.invasive.org/weeds/asian/paulownia.pdf [2010, January 20]. 5. Flora of China. http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200020800 [2010, January 22]. 6. Missouri Botanical Garden, Kemper Center for Home Gardening. http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22]. 7. Ohwi, J. (1965) <i>Flora of Japan (Engl. ed.)</i> National Science Museum, Tokyo, Japan. Eds. Meyer, F.G. & Walker, E.H. Smithsonian Institute, Washington D.C.</p>	<p>1. Distribution in the native and cultivated ranges is widespread; more than likely at least 3 climatic groups. 2. Native to Asia-Temperate: China. 3.a. Native to eastern and central China, where it occurs south of the 32°F (0°C) isotherm. 3.b. Cold climates may limit establishment and spread; USDA hardiness zones 7-10, where average temperatures range from 0°-40°F (-18°-4°C) are considered most favorable. 4. Occurs naturally at elevations below 1800 m in Henan, Hubei, Shaanxi, and probably northern Sichuan (China). 5. Cultivated or wild; below 1800 m. Anhui, Gansu, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, S Liaoning, Shaanxi, Shandong, Shanxi, N Sichuan [cultivated in North America, Europe, Japan, and Korea]. 6. Native range: central and western China. 7. Much cultivated in our area and reportedly wild in Kyushu (Japan).</p>
2.04	<p>1. Royal Paulownia. Available: http://na.fs.fed.us/pubs/silvics_manual/volume_2/paulownia/tomentosa.htm [2010, January 20].</p>	<p>1. In China, the natural range is south of the south of the 32°F (0°C) isotherm in areas which receive an annual rainfall of at least 40 in (1020 mm).</p>

<p>2.05 (a)</p>	<p>1.a-b. Csurhes, S. & Edwards, R. (1998) <i>Potential environmental weeds in Australia: Candidate species for preventative control</i>. Canberra, Australia. Biodiversity Group, Environment Australia; Swarbrick, J.R. and D.B. Skarratt (1994) The Bushweed 2 Data Base of Environmental Weeds in Australia. The University of Queensland, Brisbane, Australia. 2. Flora of China. Available: http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200020800 [2010, January 22]. 3. Holm, L. et al. (1979) <i>A Geographical Atlas of World Weeds</i>. John Wiley and Sons, New York. 4. Swearingen, J., K. Reshetiloff, B. Slattery, and S. Zwicker. 2002. Plant Invaders of Mid-Atlantic Natural Areas. National Park Service and U.S. Fish & Wildlife Service, 82 pp. Available: http://www.invasive.org/eastern/midatlantic/pato.html [2010, January 20]. 5. Invasive Plant Atlas of New England. <i>Paulownia tomentosa</i> (Princess Tree). Available at: http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=83 [2010, January 20]. 6. USDA Forest Service, Forest Health Staff, Newtown Square, PA (2005). Available: Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants [2010, January 20].</p>	<p>1.a. Introduced into the USA in 1834 and immediately escaped cultivation, becoming naturalised from Georgia to New York. 1.b. Ornamental use and forestry trials (i.e. introduced and cultivated) in Queensland, Australia. 2. Cultivated in North America, Europe, Japan, and Korea. 3. Present as a weed (present and behaves as a weed, but its rank of importance in unknown). 4. Imported to Europe by the Dutch East India Company in the 1830s and brought to North America soon after. 5. <i>Paulownia tomentosa</i> was introduced into the United States in 1844 as a horticultural plant. It is likely that this plant made its way into New England by intentional plantings as an ornamental, and then dispersed from these points of introduction. 6. It is reported invasive in CT, DC, GA, KY, LA, MD, NC, NJ, OR, PA, TN, VA, WV.</p>
<p>2.05 (b)</p>	<p>7. Missouri Botanical Garden, Kemper Center for Home Gardening. <i>Paulownia tomentosa</i>. Available: http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22]. 8. Webb, C.J. et al. (1988) <i>Flora of New Zealand, Volume IV: Naturalised pteridophytes, gymnosperms, dicotyledons</i>. Botany Division, DSIR, Christchurch. 1365 pp. at Pacific Island Ecosystems at Risk (PIER). Available: http://www.hear.org/pier/species/paulownia_tomentosa.htm [2010, January 20]. 9. Gleason, H.A. & A. Cronquist (1991) <i>Manual of Vascular Plants of NE U.S. and Adjacent Canada, 2nd Ed.</i> 910p. The NY Botanic Garden, Bronx, NY. 10. Stace, Clive (1997) <i>New Flora of the British Isles, 2nd Ed.</i> 1130p. Cambridge University Press, United Kingdom. 11. Howell, C. (New Zealand Plant Conservation Network) (2005) <i>New Zealand Adventive Vascular Plant List</i>.</p>	<p>7. First introduced into the United States in the mid 1800s, and has since escaped cultivation and naturalized in many areas of the eastern U.S. 8. Introduced, invasive, cultivated in New Zealand; "Occasionally in the vicinity of gardens, esp. in pavement cracks of similar places." 9. Escaped from cultivation in s. U.S. and n. to se. CT, PA, OH, IN, MO. 10. In Middlesex since at least 1990; introduced as ornamental planted in parks and by roads, naturalized in rough ground. 11. Fully naturalized.</p>

3.01	<p>1. Csurhes, S. & Edwards, R. (1998) <i>Potential environmental weeds in Australia: Candidate species for preventative control</i>. Canberra, Australia. Biodiversity Group, Environment Australia; Swarbrick, J.R. and D.B. Skarratt (1994) <i>The Bushweed 2 Data Base of Environmental Weeds in Australia</i>. The University of Queensland, Brisbane, Australia. 2. Holm, L. et al. (1979) <i>A Geographical Atlas of World Weeds</i>. John Wiley and Sons, New York. 3. USDA Forest Service, Forest Health Staff, Newtown Square, PA (2005). Available: Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants [2010, January 20]. 4. Missouri Botanical Garden, Kemper Center for Home Gardening. <i>Paulownia tomentosa</i>. http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22]. 5. Webb, C.J. et al. (1988) <i>Flora of New Zealand, Volume IV: Naturalised pteridophytes, gymnosperms, dicotyledons</i>. Botany Division, DSIR, Christchurch. 1365 pp. at Pacific Island Ecosystems at Risk (PIER). http://www.hear.org/pier/species/paulownia_tomentosa.htm [2010, January 20]. 6. Gleason, H.A. & A. Cronquist (1991) <i>Manual of Vascular Plants of NE U.S. and Adjacent Canada, 2nd Ed</i>. 910p. The NY Botanic Garden, Bronx, NY. 7. Stace, Clive (1997) <i>New Flora of the British Isles, 2nd Ed</i>. 1130p. Cambridge University Press, United Kingdom. 8. Howell, C. (New Zealand Plant Conservation Network) (2005) New Zealand Adventive Vascular Plant List.</p>	<p>1. Introduced into the USA in 1834 and immediately escaped cultivation, becoming naturalised from Georgia to New York. 2. Present as a weed (present and behaves as a weed, but its rank of importance in unknown). 3. It is reported invasive in CT, DC, GA, KY, LA, MD, NC, NJ, OR, PA, TN, VA, WV. 4. First introduced into the United States in the mid 1800s, and has since escaped cultivation and naturalized in many areas of the eastern U.S. 5. Introduced, invasive, cultivated in New Zealand; "Occasionally in the vicinity of gardens, esp. in pavement cracks of similar places." 6. Escaped from cultivation in s. U.S. and n. to se. CT, PA, OH, IN, MO. 7. In Middlesex since at least 1990; introduced as ornamental planted in parks and by roads, naturalized in rough ground. 8. Fully naturalized.</p>
3.02	<p>1. Horticipia A-Z. CD-ROM database. 2. http://www.hear.org.</p>	<p>1. The tree is often considered a weed tree, and has naturalized in the edge of woodlands, along railroad rights-of-way, and in other areas of disturbed soil in eastern North America. 2. The trees also cause maintenance problems along roads and utility rights-of-way and in gardens.</p>
3.03		No evidence.

3.04	<p>1.a-b. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2.a-d. TN-EPPC Invasive Exotic Pest Plants in Tennessee December 2009 (2nd Edition). Available: http://www.tneppc.org/invasive_plants [2010, January 27]. 3. Missouri Botanical Garden, Kemper Center for Home Gardening. <i>Paulownia tomentosa</i>. Available: http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22]. 4. Innes, Robin J. 2009. <i>Paulowina tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 5. Langdon, K.R. & K.D. Johnson (1994) Additional Notes on Invasiveness of <i>Paulownia tomentosa</i> in Natural Areas. <i>Natural Areas Journal</i>. 14(2): 139-140.</p>	<p>1.a. A highly adaptable 'escapee,' <i>P. tomentosa</i> is found in many site, soil, and forest type conditions. 1.b. Like most pioneer species, <i>P. tomentosa</i> needs bare soil, sufficient moisture, and direct sunlight for good seedling establishment. 2.a. Listed as a Severe Threat on TNEPPC List; often found on roadsides, stream banks, and disturbed habitats, including fire sites, forests defoliated by pests (e.g., gypsy moths), and landslides. 2.b. Sprouts prolifically from adventitious buds on stems and roots allow it to survive fire, cutting, and even bulldozing in construction areas. 2.c. <i>Paulownia</i> can colonize rocky cliffs and scoured riparian zones where it may compete with rare plants in these marginal habitats. 2.d. Can reproduce from seed or from root sprouts, the latter can grow to over 15 feet (5m) in a single year. 3. Will naturalize. 4.a. Princess tree frequently establishes and spreads after disturbances that create these conditions, such as fire, windstorms, pestilence, floods, landslides, and anthropogenic disturbances such as construction, cultivation, mining, and logging. 4.b. In the Southeast, it is typically considered a substantial or severe threat to native communities. 5.a. We know of several wildfires that have resulted in significant reproduction of this exotic, even though the closest parent trees were a few kilometers away. 5.b. The park's (Great Smoky Mountains National Park in TN and NC) future fire program may repetitively create favorable seedbed conditions in these areas.</p>
3.05		No evidence.
4.01		No evidence.
4.02	<p>1. USDA-NRCS Plants Database [online database] Conservation Plant Characteristics for <i>Paulownia tomentosa</i>. Available: http://plants.usda.gov/java/charProfile?symbol=PATO2 [2010, January 22].</p>	1. Known allelopath: No.
4.03		No evidence
4.04	<p>1.a-b. Innes, Robin J. 2009. <i>Paulowina tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 2. Longbrake, A. Christina W. (2001) Ecology and invasive potential of <i>Paulownia tomentosa</i> (Scrophulariaceae) in a hardwood forest landscape. Athens, Ohio: Ohio University. 174p. Dissertation.</p>	<p>1.a. Domestic livestock and wildlife regularly consume leaves, flowers, and branches. 1.b. Leaves were highly palatable to domestic goats in experimental studies; leaves appear to be equally palatable to wildlife. 2. High rates of herbivory were observed on young seedlings by unspecified burrowing mammals and white-tailed deer in forest, edge, and clearcut habitats in Ohio.</p>

4.05	<p>1. USDA-NRCS Plants Database [online database] Conservation Plant Characteristics for <i>Paulownia tomentosa</i>. Available: http://plants.usda.gov/java/charProfile?symbol=PATO2 [2010, January 22].</p>	<p>1. Toxicity: None</p>
4.06	<p>1. Missouri Botanical Garden, Kemper Center for Home Gardening. <i>Paulownia tomentosa</i>. Available: http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22]. 2. Innes, Robin J. 2009. <i>Paulowina tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 3. Yue, H.N. et al. 2008. First report of <i>Paulowina Witches'-Broom</i> phytoplasma in China. <i>Plant Disease</i> 92(7): 1134.</p>	<p>1. 1. No serious insect or disease problems. 2. Fungi (<i>Rhizoctonia</i> sp., <i>Colletotrichum</i> sp.) that infected seedlings and caused die-back in field experiments in KY; and foliage diseases causing at least superficial damage (<i>Phyllosticta paulowniae</i>, <i>Phyllactinia guttata</i>, and <i>Uncinula clintonii</i>) are known to adversely affect princess tree. 3. <i>Paulownia witches'-broom</i> (PaWB) is one of the most important diseases affecting <i>Paulownia tomentosa</i>.</p>
4.07	<p>1. USDA-NRCS Plants Database [online database] Conservation Plant Characteristics for <i>Paulownia tomentosa</i>. Available: http://plants.usda.gov/java/charProfile?symbol=PATO2 [2010, January 22]. 2. Missouri Botanical Garden, Kemper Center for Home Gardening. <i>Paulownia tomentosa</i>. Available: http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22].</p>	<p>1. Toxicity: None. 2. Flowers are edible and are sometimes added to salads.</p>
4.08	<p>1. USDA-NRCS Plants Database [online database] Conservation Plant Characteristics for <i>Paulownia tomentosa</i>. Available: http://plants.usda.gov/java/charProfile?symbol=PATO2 [2010, January 22]. 2. Innes, Robin J. 2009. <i>Paulowina tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 3. Sand, S. (1992) The Empress Tree; <i>Paulownia tomentosa</i> has been both vilified and venerated. <i>American Horticulturist</i>. 71(6): 27-29.</p>	<p>1. Fire resistant: No. 2.a. The above ground portion is probably easily killed by fire. The brittle branches, thin flaky bark, and large leaves suggest that it has a good potential for crowning fires. 2.b. Princess tree is not considered a fire hazard; has low thermal and temperature conductivity and thus very high heat insulation properties and low combustibility relative to other species. Relatively high moisture content and low ignitability of chemicals in the plant partially explain its low combustibility and consumption in fire. 3. In Japan, it was custom to plant <i>Paulownia tomentosa</i> upon the birth of a daughter and harvest it to make a bridal chest when she reached marriageable age because the wood was fire-resistant and protected the storage of items, even when the owners' straw houses were destroyed by fire.</p>

4.09	<p>1. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2. USDA-NRCS Plants Database [online database] Conservation Plant Characteristics for <i>Paulownia tomentosa</i> . Available: http://plants.usda.gov/java/charProfile?symbol=PATO2 [2010, January 22]. 3. Missouri Botanical Garden, Kemper Center for Home Gardening. Available: http://www.mobot.org/gardeninghelp/plantfinder/Plant.asp?code=A888 [2010, January 22]. 4. Innes, Robin J. 2009. <i>Paulownia tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].</p>	<p>1. Seedlings are very intolerant of shade. 2. Shade tolerance: Intolerant. 3. Tolerates light shade, but is generally intolerant of shady conditions. 4. Princesstree is an early-successional species that is intolerant of shade.</p>
4.10	<p>1.a-b. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2. Innes, Robin J. 2009. <i>Paulownia tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].</p>	<p>1.a. A highly adaptable 'escapee,' <i>P. tomentosa</i> is found in many site, soil, and forest type conditions, including soils commonly found in the order Alfisols. 1.b. SE-EPPC reports the <i>P. tomentosa</i> "tolerates high soil acidity, drought, and low soil fertility." 2.a. Grows best on moist, uncompacted, well-drained soils. 2.b. Best growth is obtained within strongly acidic to mildly alkaline pH levels (range: 5.5-7.5). 2.c. Soil texture may play a role in invasiveness; sandy or loamy soils with low clay content appear optimum. 2.d. Nitrogen and phosphorus are essential for tree growth; tolerant of low soil fertility but grows better in fertile soils.</p>
4.11		No evidence.
4.12		No evidence.
5.01		
5.02		
5.03	<p>1. USDA-NRCS Plants Database [online database] Conservation Plant Characteristics for <i>Paulownia tomentosa</i> . Available: http://plants.usda.gov/java/charProfile?symbol=PATO2 [2010, January 22].</p>	<p>1. Nitrogen fixation: None.</p>
5.04		No evidence.
6.01		No evidence.

6.02	<p>1. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2. Innes, Robin J. 2009. <i>Paulowina tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].</p>	<p>1. <i>P. tomentosa</i> spreads by seed. 2. Reproduces from seed.</p>
6.03		<p>No evidence.</p>
6.04	<p>1. Innes, Robin J. 2009. <i>Paulowina tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].</p>	<p>1. Winged seeds are easily transported by wind and water over considerable distances; seedling have been observed more than 2 miles (3 km) from parent species in mountainous regions of NC and TN.</p>
6.05		
6.06	<p>1. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2. TN-EPPC Invasive Exotic Pest Plants in Tennessee December 2009 (2nd Edition). Available: http://www.tneppc.org/invasive_plants [2010, January 27].</p>	<p>1. <i>P. tomentosa</i> also spreads by suckering. 2. Sprouts prolifically from adventitious buds on stems and roots; can reproduce from root sprouts, that can grow to over 15 feet (5m) in a single year.</p>
6.07	<p>1. Innes, Robin J. 2009. <i>Paulowina tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 2. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20].</p>	<p>1. Princess tree reaches reproductive age early; time to maturity depends upon environmental conditions. It may flower in as early as its 4th or 5th year; under cultivation it may flower as early as the 3rd year. 2. <i>P. tomentosa</i> trees start bearing seed after 8 to 10 years and are very prolific.</p>
7.01	<p>1. Stace, Clive (1997) <i>New Flora of the British Isles</i>, 2nd Ed. 1130p. Cambridge University Press, United Kingdom. 2. Huxley, A. (1992) <i>New Royal Horticultural Society Dictionary of Gardening</i>. Macmillan Press, London</p>	<p>1. In Middlesex since at least 1990; introduced as ornamental planted in parks and by roads. 2. The pollution-tolerant <i>P. tomentosa</i> is grown as a street and park tree in cities of continental Europe.</p>

7.02	1.a-b. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20].	1.a. <i>P. tomentosa</i> introduced into the USA as an ornamental, and still remains some popularity for that purpose. 1.b. The wood of <i>P. tomentosa</i> is highly prized for the manufacture of specialty items in Asia, and there is a brisk export business of logs to Japan, which has led to the establishment of commercial plantations.
7.03		No evidence.
7.04	1. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2. Liu, K., Eastwood, R.J., Flynn, S., Turner, R.M., and Stuppy, W.H. 2008. Seed Information Database (release 7.1, May 2008). Available: http://data.kew.org/sid/SidServlet?ID=17129&Num=9vm [2010, January 22]. 3. TN-EPPC Invasive Exotic Pest Plants in Tennessee December 2009 (2nd Edition). Available: http://www.tneppc.org/invasive_plants [2010, January 27]. 4. Innes, Robin J. 2009. <i>Paulowina tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].	1. As the capsules break open on the trees throughout the winter and into the spring, tiny, flat, winged seeds disseminate by wind very easily. 2. Diaspore is blown by wind (assumption based upon diaspore morphology; diaspore has wings or wing-like features). 3. Seeds are easily transported in water or wind. 4. Winged seeds are easily transported by wind and water over considerable distances; seedling have been observed more than 2 miles (3 km) from parent species in mountainous regions of NC and TN.
7.05	1. TN-EPPC Invasive Exotic Pest Plants in Tennessee December 2009 (2nd Edition). Available: http://www.tneppc.org/invasive_plants [2010, January 27]. 2. Innes, Robin J. 2009. <i>Paulowina tomentosa</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].	1. Seeds are easily transported in water or wind. 2. Winged seeds are easily transported by wind and water over considerable distances; seedling have been observed more than 2 miles (3 km) from parent species in mountainous regions of NC and TN.
7.06		No evidence.
7.07		No evidence.
7.08		No evidence.

8.01	<p>1.a-b. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 1.a. Innes, Robin J. 2009. <i>Paulownia tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].</p>	<p>1.a. Each capsule contains up to 2000 seeds (a large tree may produce as many as 20 million seeds a year). 1.b. When <i>P. tomentosa</i> trees start bearing seed they are very prolific.</p>
8.02	<p>1. Global Invasive Species Database (ISSG). Available: http://www.issg.org/database/species/ecology.asp?si=440&fr=1st [2010, January 20]. 2.a-c. Innes, Robin J. 2009. <i>Paulownia tomentosa</i>. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22]. 3. Longbrake, A. Christina W. (2001) Ecology and invasive potential of <i>Paulownia tomentosa</i> (Scrophulariaceae) in a hardwood forest landscape. Athens, Ohio: Ohio University. 174p. Dissertation.</p>	<p>1. Seeds can remain in a seed bank for at least 3 years becoming dormant sometime in the late summer with very little seed predation. 2.a. Develops a transient seedbank; long-distance dispersal and prolific seed production apparently allow it to establish a transient seed bank from on-and offsite sources. 2.b. Seeds can survive in the soil seed bank for at least 2 to 3 years. 2.c. In debris avalanches following Hurricane Camille, princess tree established at densities up to 310 stems/ha, despite its absence from adjacent, undisturbed hardwood forest. 3. Princess tree formed a persistent seed bank and seeds could possibly survive in the soil for up to 15 years.</p>
8.03	<p>1.a-d. TN-EPPC Invasive Exotic Pest Plants in Tennessee December 2009 (2nd Edition). Available: http://www.tneppc.org/invasive_plants [2010, January 27]. 2. Tu, Mandy (2002) Weed Notes: <i>Paulownia tomentosa</i> (Princess tree, empress tree, royal paulownia). The Nature Conservancy Wildland Invasive Species Team. Available: http://www.invasive.org/gist/moredocs/pautom01.pdf [2010, January 20].</p>	<p>1.a. Foliar spray methods should be considered for large thickets of <i>Paulownia</i> seedlings where risk to non-target species is minimal and temperature should be above 65°F = Glyphosate at 2% or Triclopyr at 2%. 1.b. Cut stump control method should be considered when treating individual trees or where the presence of desirable species preclude foliar application, and as long as ground does not freeze = Glyphosate at 25% covering outer 50% of the stump or Triclopyr at 50% covering outer 20% of the stump. 1.c. Basal Bark Method is effective throughout the year as long as the ground is not frozen. Apply a mixture of 25% triclopyr and 75% horticultural oil to the basal parts of the tree to a height of 30-38 cm (12-15 in) from the ground. 1.d. Hack and Squirt, make cuts at 6.5 cm (3 in) intervals around the trunk of the tree between 15-45 cm (6-18 in) above the ground. Be sure that each cut goes well into or below the cambium layer. Immediately treat the cut with a 50% glyphosate or triclopyr and water herbicide solution. 2. <i>Paulownia tomentosa</i> can be controlled most effectively using an integrated management approach. Cutting or girdling trees with power or manual saws are effective at preventing seed production, but</p>

8.04	<p>1.a. Innes, Robin J. 2009. Paulowina tomentosa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, January 22].</p>	<p>1.a. Princesstree frequently establishes and spreads after disturbances that create these conditions, such as fire, windstorms, pestilence, floods, landslides, and anthropogenic disturbances such as construction, cultivation, mining, and logging. 1.b. Invades readily after disturbance, prescribed fire and fuels management activities may increase its population. 1.c. <i>P. tomentosa</i> also spreads by suckering after cutting.</p>
8.05		