

Ohio Invasive Plant Assessment Protocol

Botanical Name: *Paulownia tomentosa*
 Common Name: Princess Tree, Empress Tree Step I Outcome: **Continue**
 Family Name: Paulowniaceae Step II Score: **36**
 Posted Date: 7/20/16 Step II Outcome: **Pending Further Review**
 Initial assessment conducted by: Theresa Culley

Score **Notes** **References**

Step I

Directions: Place an "X" in the Score column next to the selected answer to each of the four questions.

1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?	Yes. <i>Place on invasive plant list, no further investigation needed. STOP</i> No. <i>Continue on to question 2.</i>	X		
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?^a	Yes. <i>Place on invasive plant list, no further investigation needed. STOP</i> No. <i>Continue on to question 3.</i>	X	Reference 1: 2 regions (4 & 5); Reference 2: 3 regions (3,4 & 5). Note that information regarding widespread dispersion and establishment information is not included in the references.	1,2
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?	Yes No Unknown	X	Species is known to form self-replicating populations outside of cultivation, but its ability to alter natural ecosystems is unclear.	1,2
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?^{b,c}	Yes No Unknown	x	IN,PA [also in KY but not included here]	3,4,6

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II.

Step II: Invasion Status

Directions: Place the appropriate numerical score (or "U") in the Score column next to the selected answer to each of these 18 questions.

1. Current Invasion in Ohio - plant is not found in natural areas (0 pts.) - plant is found in natural areas but only because it persist from previous planting in that location (e.g. old home sites) (0 pts.) - plant is only expanding from sites of previous planting (1 pt.) - plant occurs in natural areas away from site of planting (3 pts.) - Information unknown (U)		3	Species is a long-distance disperser, able to colonize disturbed habitats.	1,2,3,7,8
2. State Distribution^a - plant is not naturalized in any region of Ohio (0 pts.) - plant is naturalized in only one region in Ohio (1 pt.) - plant is naturalized in two regions in Ohio (2 pts.) - plant is naturalized in three regions in Ohio (3 pts.) - plant is naturalized in four regions in Ohio (4 pts.) - plant is naturalized in five regions in Ohio (5 pts.) - Information unknown (U)		3	Reference 2 is most recent (3 regions). 18: In 1969, Lucy Braun noted that prinescstree was abundant on some mesic slopes and in valley forests in the Appalachian Plateau and Ohio River Valley in OH. 19: Regions 3,4,5	1,2,18,19
3. Regional/US Distribution - plant is not considered to be a problem in any other state (0 pts.) - plant has been reported as a widespread problem in another non-neighboring state within the USDA Plant Hardiness Zones 5-6 (1 pt.) - plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.) - plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		5	IN,PA,CN,WV [also in KY but not included here]	3,4,6,8,20

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- plant has been reported to be a widespread problem in similar habitat outside the US (1 pt.)
- Information unknown (U)

Step II: Biological Characters

4. Vegetative Reproduction

- no vegetative reproduction (0 pts.)
- reproduces readily within the original site (1 pt.)
- has runners or spreading rhizomes that root easily (3 pts.)
- fragments easily and fragments can be easily dispersed (4 pts.)
- has runners or spreading rhizomes that root easily AND fragments easily and fragments can be easily dispersed (5 pts.)
- Information unknown (U)

3

8: Has adventitious buds on stems and roots which play important role in species "reproductive success and invasiveness."
22: Can resprout easily after herbivory.

8,22

5. Sexual Reproduction

- no sexual reproduction (0 pts.)
- infrequent sexual reproduction (1 pt.)
- frequent sexual reproduction, but high variation among years in seed production (3 pts.)
- frequent sexual reproduction (one or more events per year) (5 pts.)
- Information unknown (U)

3

Sexual reproduction occurs after ~10 years of age, but it is unclear how variable seed production is (light plays an important role), therefore, a conservative answer of 3 points is used. Further research is likely to increase this answer to 5 points.

8

6. Number of Viable Seeds or Propagules per Plant

- few (0-10) (1 pt.)
- moderate (11-1,000) (3 pts.)
- prolific (>1,000) (5 pts.)
- Information unknown (U)

5

7,8: a single tree can produce millions of seeds. 9: 2 million seeds/year. 15: Seed germination is between 40-70%, depending on soil type and treatment; princess tree exhibits high biomass. 23: Seedlings have an approx. 75% overwintering survival their first year (in SE OH); capsules release more than 2,000 seeds each in late fall and early winter; seed mortality was only 21% after three years with germination over 80%; germination was highest on pure soil; species forms a persistent seed bank.

7,8,9,15,23

7. Flowering Period

- one month or less per year (0 pts.)
- two months (1 pt.)
- three to five months (2 pts.)
- longer than five months (3 pts.)
- Information unknown (U)

0

1 month

8

8. Dispersal Ability

- low potential for long-distance seed/propagule dispersal (>1km) (0 pts.)
- medium potential for long-distance seed/propagule dispersal (3 pts.)
- high potential for long-distance seed/propagule dispersal (5 pts.)
- Information unknown (U)

5

7: the small seeds "have been measured at 3.5 km from the nearest mature individual."

7,8,9

9. Generation Time

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Step II

- long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)
 - short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)
 - Information unknown (U)

0 7,8: 8-10 years. 9: 7-10 years. 7,8

10. Establishment

- unable to invade natural areas (0 pts.)
- can only colonize certain habitat stages (e.g. early successional habitats) (1 pt.)
- aggressively colonizes and establishes in edge habitats (3 pts.)
- aggressively colonizes and establishes in intact and healthy natural areas (6 pts.)
- Information unknown (U)

3 7: very rapid growth (over 2 m/year for seedlings). 8: "Princesstree seedling establishment may be infrequent and widely scattered." The species depends on high light conditions for germination and development. 10: Princesstree is planted as a timber tree in the South but it goes too fast for the wood to be valuable. 13: Fire promotes princesstree invasion. 16: "all tested components of fire, except elevated temperature, operate to stimulate germination of *P. tomentosa* seeds, suggesting that the post-fire invasive potential of this species can, at least in part, be explained at the germination level."; "Paulownia tomentosa seedlings can resprout at an early age, even in low light." 22: "although resprout ability is dependent upon belowground biomass, *P. tomentosa* seedlings can resprout at an early age, even in low light. This ability may allow the species to become established even in areas of high herbivore density." 23: "The clear cut habitat had the greatest human disturbance and was most favorable for growth and survival of the species. However, the edge habitat was also conducive to survival and growth [in SE OH]."; "Resprouting of clipped plants was more prevalent in artificial edge and full sun treatments". 8,10,13,16,22,23

Step II: Ecological Importance

11. Impact on Ecosystem Processes

- no known effect on ecosystem-level processes (0 pts.)
- moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)
- causes long-term, substantial alterations in the ecosystem (e.g., changing fire regime of an area, changing hydrology of wetlands) (6 pts.)

0 8: no evidence. 13: Fire promotes princesstree invasion. 14: Princesstree can be used for effective soil bioremediation. 8,13,14

12. Impact on Rare Organisms

- no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)

7: This species creates a displacement

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<ul style="list-style-type: none"> - negatively impacts listed species, such as through displacement or interbreeding (3 pts.) 	0	<p>concern for <i>Liatris helleri</i> and <i>Hudsonia montana</i>, two federally threatened plant species in North Carolina [not considered here since these species do not occur in OH].</p>	7
<p>13. Impact on Native Animals</p> <ul style="list-style-type: none"> - no known negative impact on animals (0 pts.) - documented direct or indirect negative effects on animal taxa (3 pts.) 	0	<p>no evidence</p>	
<p>14. Impact on Native Plants</p> <ul style="list-style-type: none"> - no known negative effects on native plants (0 pts.) - negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.) - impacts native plants to such an extent that community structure is greatly altered (6 pts.) 	3	<p>7: Is able to outcompete many native plants in rocky outcrop areas where resources are limited, shade is lacking.</p>	7
<p>15. Hybridization</p> <ul style="list-style-type: none"> - no known instances of hybridization with other plant species (0 pts.) - can hybridize with native Ohio plants or commercially-available species, but seeds are inviable (1 pt.) - can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.) 	0	<p>11,12: Species is capable of hybridizing with <i>P. fortunei</i>, but BONAP does not show <i>P. fortunei</i> in the US.</p>	11,12
<p>16. Population Density</p> <ul style="list-style-type: none"> - occurs only as small, sporadic populations or individuals (1 pt.) - typically forms small, monospecific patches (3 pts.) - is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.) - forms an extensive, monospecific stand (absolute cover >50%) (5 pts.) 	1	<p>8: Species rarely forms monospecific stands.</p>	8
<p>17. Role in Succession in Natural Areas</p> <ul style="list-style-type: none"> - successional information is unknown (0 pts.) - is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (0 pts.) - readily invades disturbed sites and persists, but does not interfere with succession (1 pt.) 		<p>7: Species very intolerant of shade and does not "compete well in forest understories", but it "has been observed in</p>	

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- readily invades disturbed sites, persists and interferes with succession of native plants (4 pts.)

1

xeric Pinus-dominated forests following fires"; "Following its initial widespread establishment, *P. tomentosa* only persisted on xeric and exposed topographic positions that experienced high intensity burning"; "Like many early successional species, *P. tomentosa* is able to germinate and establish across a large range of post-disturbance environmental conditions. However, the persistent niche of disturbance specialists such as *P. tomentosa* is often limited by changing environmental conditions associated the post-disturbance recovery and expansion of native vegetation." 13: Fire promotes princess tree invasion. 17: Species is an early-successional tree but seed germination is restricted to high light areas and species is not a good competitor in later successional stages; species needs major disturbance in order to invade (at least in 1993 in the US southeast). 23: "Naturalized populations flourish along highways and waterways and have persisted for at least twenty years" [in OH]; and "Volunteer plants have recently been found in intact secondary forest in southeastern Ohio on newly created tip up mounds (B. C. McCarthy, pers. obs.)."

7,8,13,17,23

18. Number of Habitats Invaded

Forestlands: Floodplain forest, hemlock-hardwood forest, mixed mesophytic forest, beech-maple forest, oak-maple forest, oak-hickory forest.
Grasslands: Alvar, beach-dune community, bur oak savanna, slough-grass-bluejoint prairie, sand barren, big bluestem prairie, little bluestem prairie (xeric limestone prairie), and
Wetlands: Bog, fen, twig-rust-wiregrass wet prairie, marsh, buttonbush swamp, mixed shrub swamp, nemoack-hardwood swamp, maple-aspen-oak swamp, white pine-red maple swamp*
 * Considered a rare plant community in Ohio by ODW's Biodiversity Database Program.
 + = xeric limestone prairies or cedar glades and post oak openings are unique to the interior Low Plateau Region of Adams, Highland and Pike counties, and are not included in Schneider and Cochran (1997).

- not found in any natural habitats in Ohio (0 pts.)
- only found in 1 broad category (1 pt.)
- found in 2 broad categories or 2 rare habitat types (3 pts.)
- found in 3 broad categories or 3 rare habitat types (4 pts.)

8: It is found if forest edges, and occasionally in the interior where there has been a light gap. 17: naturalizes along roadsides, forest edges, and disturbed

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- found in 4 or more rare habitat types (5 pts.)	1	woodlots, and in streamside forests, growing as scattered individuals or in small stands in the Southeast. 18: In 1969, Lucy Braun noted that princess tree was abundant on some mesic slopes and in valley forests in the Appalachian Plateau and Ohio River Valley in OH. 23: "Volunteer plants have recently been found in intact secondary forest in southeastern Ohio on newly created tip up mounds (B. C. McCarthy, pers. obs.);" this plant is a typical sun-adapted species that is a shade intolerant species, but "it shows a rapid ability to acclimate to low light conditions."; it will likely extend its range northward in OH with global warming; "often found on steep cobbley soils along highways and waterways".	8,17,18,23

Total Score:
Number of Unknowns:
Outcome:

36
 0
 Pending Further Review

Total Points	Assessment Decision
4 or more U	Insufficient Data
0-34	Not Known to be Invasive
35-44	Pending Further Review
45-80	Invasive