Plant Risk Evaluator -- PRE™
Evaluation Report

Paulownia tomentosa -- Georgia

2017 Farm Bill PRE Project

PRE Score: 16 -- Reject (high risk of invasiveness)
Confidence: 60 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

Privacy: Public
Status: Completed

Evaluation Date: October 25, 2017

This PDF was created on July 06, 2018

Plant Evaluated

Paulownia tomentosa

Image by Jean-Pol GRANDMONT

Evaluation Overview

A PRE™ screener conducted a literature review for this plant (*Paulownia tomentosa*) in an effort to understand the invasive history, reproductive strategies, and the impact, if any, on the region's native plants and animals. This research reflects the data available at the time this evaluation was conducted.

Summary

Princesstree (Paulownia tomentosa) is native to China and has been introduced to the U.S. since the 1840s. It has since been listed as weedy or invasive by several states throughout the Eastern United States. Princesstree can grow as tall as 50ft, and produces heart-shaped leaves with showy lavender flowers. After fruiting, one princesstree can produce as many as twenty million seeds. Though having relatively low seed survival and germination rates, tomentosa can establish quickly given enough light, and mature very quickly. For these reasons, P. tomentosa is a very aggressive tree in high-light areas such as roadsides, stream banks, and forest borders. It is not recommended that princesstree be cultivated in tropical zones 7-10 where it is not native.

General Information

Status: Completed
Screener: Lila Uzzell
Evaluation Date: October 25, 2017

Plant Information

Plant: *Paulownia tomentosa*

Regional Information

Region Name: Georgia

Climate Matching Map

To answer four of the PRE questions for a regional evaluation, a climate map with three climate data layers (Precipitation, UN EcoZones, and Plant Hardiness) is needed. These maps were built using a toolkit created in collaboration with GreenInfo Network, USDA, PlantRight, California-Invasive Plant Council, and The Information Center for the Environment at UC Davis.

Click here to see the generated climate matching map for this region. This climate match database is hosted by GreenInfo Network and publicly accessible.

Evaluation Questions

These questions are based in an original article published at the University of California, Davis, and can be found on the PLOS One website, here: https://doi.org/10.1371/journal.pone.0121053

Invasive History and Climate Matching (Questions 1 - 6)

1. Has the species (or cultivar or variety, if applicable; applies to subsequent "species" questions) become naturalized where it is not native?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

Paulownia tomentosa is native to China,but has been introduced as an ornamental tree to places such as the U.S. It grows very rapidly throughout disturbed areas of Eastern and Northwestern U.S. "Paulownia has been naturalized in the eastern U.S. for more than 150 years and is also grown on the west coast. USDA hardiness zones 7-10 are most favorable".

Reference(s):

- Southeast Exotic Pest Plant Council (2017). Princess Tree, Paulownia tomentosa - Southeast Exotic Pest Plant Council Invasive Plant Manual.

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2. Is the species (or cultivar or variety) noted as being naturalized in the US or world in a similar climate?

- Answer: **Yes**, which contributes **2** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

In matching GBIF P. tomentosa distribution to the Georgia PRE Climate Profile, P. tomentosa grows readily in climate regions similar to Georgia. "USDA hardiness zones 7-10 are most favorable." That is, Temperate mountain systems, and Tropical humid forests.

Reference(s):

- GBIF (2017). Paulownia tomentosa (Thunb.) Steud. -- GBIF.
- Southeast Exotic Pest Plant Council (2017). Princess Tree, Paulownia tomentosa - Southeast Exotic Pest Plant Council Invasive Plant Manual.

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3. Is the species (or cultivar or variety) noted as being invasive in the U.S. or world?

- Answer: **Yes**, which contributes **2** points to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

The Georgia EPPC has this species listed as a category 1 invasive, and other states across the Eastern and Southeastern U.S. list this species as invasive.

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (2017). princesstree, Paulownia tomentosa N/A Scrophulariales: Scrophulariaceae.

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4. Is the species (or cultivar or variety) noted as being invasive in the US or world in a similar climate?

- Answer: **Yes**, which contributes **3** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

This species is noted as being invasive in several states within the U.S. in a similar climate (AL,PA,CT,KT,MD,OR,NJ, NC, SC, and VA), and is listed as invasive by the ISSG, as noted in the Compendium of Weeds, and on the ISSG webpage. The ISSG notes this species as invasive in Queensland Australia (note: only very small areas of queensland AUS are of similar climate).

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (2017). princesstree, Paulownia tomentosa N/A Scrophulariales: Scrophulariaceae.
- Invasive Species Specialist Group (2017). GISD - Paulownia tomentosa.
- Randall, R. (2012). A Global Compendium of Weeds. 2nd Edition..

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5. Are other species of the same genus (or closely related genera) invasive in a similar climate?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

The Global Compendium of Weeds does not list any other species within the Paulownia genus as invasive. Perhaps more sources should be researched to answer this question.

Reference(s):

- Randall, R. (2012). A Global Compendium of Weeds. 2nd Edition..

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6. Is the species (or cultivar or variety) found predominately in a climate matching the region of concern?

- Answer: **Yes**, which contributes **2** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

In comparing the climate map with P. tomentosa locations globally from GBIF, this species is found in all regions of a similar climate, excluding Argentina.

Reference(s):

- GBIF (2017). Paulownia tomentosa (Thunb.) Steud. -- GBIF.

Impact on Native Plants and Animals (Questions 7 - 10)

7. Does this plant displace native plants and dominate (overtop or smother) the plant community in areas where it has established?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Study sites within Virgina, Delaware, and Kentucky see the presence of princess tree as "a minor component of plant communities" or of "low importance" compared to the ranks of other tree communities. However, princess tree was seen "as an 'aggressive' invasive species within disturbed areas at the Oak Ridge National Environmental Research Park in Tennessee". According to The Southeast Exotic Pest Plant Council (SE-EPPC), P. tomentosa "grows rapidly in disturbed areas, including steep rocky slopes that may also be habitats for rare plants." Most sources point to this species as being "very agressive" so I will answer yes to this question though some sources state otherwise.

Reference(s):

- Innes, R. J. (2009). Paulownia tomentosa.
- Southeast Exotic Pest Plant Council (2017). Princess Tree, Paulownia tomentosa - Southeast Exotic Pest Plant Council Invasive Plant Manual.

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8. Is the plant noted as promoting fire and/or changing fire regimes?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Lack of evidence.

Reference(s):

- [Anonymous] .

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9. Is the plant a health risk to humans or animals/fish? Has the species been noted as impacting grazing systems?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Lack of evidence, no sources indicate that this species is a threat. It seems to not cause any health risk to humans or animals, or impact grazing.

Reference(s):

- [Anonymous] .

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10. Does the plant produce impenetrable thickets, blocking or slowing movement of animals, livestock, or humans?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Due to the fact that this species typically invades disturbed/high-light environments, it does not seem to block or slow movement of animals.

Reference(s):

- Texas Invasive Species Institute (2017). Princess Tree / Empress Tree: Texas Invasive Species Institute.

Reproductive Strategies (Questions 11 - 17)

11. Does this species (or cultivar or variety) reproduce and spread vegetatively?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

P. tomentosa can re-sprout readily from stems or roots.

Reference(s):

- Texas Invasive Species Institute (2017). Princess Tree / Empress Tree: Texas Invasive Species Institute.

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12. If naturally detached fragments from this plant are capable of producing new plants, is this a common method of reproduction for the plant?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

This tree can re-sprout from roots after being cut, and readily re-sprouts back and overtakes native species after forest fires.

Reference(s):

- Remaley, T. (2009). PCA Alien Plant Working Group - Princess Tree (Paulownia tomentosa).
- Texas Invasive Species Institute (2017). Princess Tree / Empress Tree: Texas Invasive Species Institute.

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13. Does the species (or cultivar or variety) commonly produce viable seed?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

Princess tree seeds readily grow and germinate in soils at a depth of 4inches or shorter. However, the longevity of princess tree seeds is not very long, "germination of cold-stored seeds appeared to decline sharply after 4 years".

Reference(s):

- Innes, R. J. (2009). Paulownia tomentosa.

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14. Does this plant produce copious viable seeds each year (> 1000)?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

" Fruits are light green in the summer, becoming dark brown in the winter, and persist in clusters on the tree until the following spring. The capsules split in half during late winter to release up to 2000 tiny winged, wind-borne seeds".

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (2017). princesstree, Paulownia tomentosa N/A Scrophulariales: Scrophulariaceae.

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15. Is there significant germination (>25%) of seeds the next growing season, with no requirement of an infrequent environmental condition for seeds to germinate (i.e. fire) or long dormancy period?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Germination capacity for princesstree decreases from its time of dispersal, and seed longevity is short. "In field experiments in Ohio, germination of naturally cold-stratified seeds was measured on different substrates and across light (intact forest, edge, and 7-year-old clearcut) and substrate (bare mineral soil, sand, gravel, cobble, top soil, and leaf litter) gradients. Germination was low overall (15%) and occurred only under full light (clearcut)". Princesstree seeds tend to need an "unusually high" amount of light for germination compared to other species.

Reference(s):

- Innes, R. J. (2009). Paulownia tomentosa.

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16. Does this plant produce viable seed within the first three years (for an herbaceous species) to five years (for a woody species) after germination?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Lack of evidence. Time of flowering depends on environmental conditions. It has been reported that P. tomentosa can flower as early as its third year (under cultivation practices), while other reports say it can flower as early as its 8th year. Even though flowering may occur as early as its third year, princesstree's capability of producing viable seed within its third year is not stated. Given P. tomentosas generally low seed survival and germination rates, I answered no to this question. "Princesstree reaches reproductive age early. Time to maturity depends upon environmental conditions. It may flower in favorable environments in its 4th or 5th year [78,79,101]; under cultivation it may flower as early as the 3rd year [130]. Hu [63] reports that Paulownia first flowers at 8 to 10 years of age under "suitable" conditions in China."

Reference(s):

- Innes, R. J. (2009). Paulownia tomentosa.

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17. Does this plant continuously produce seed for >3 months each year or does seed production occur more than once a year?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Lack of evidence, but given its fruiting time, it appears it only releases seeds once a year (maybe even two years) during late winter: "Fruits are light green in the summer, becoming dark brown in the winter, and persist in clusters on the tree until the following spring. The capsules split in half during late winter to release up to 2000 tiny winged, wind-borne seeds 0.08-0.12 in. (2-3 mm)."

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (2017). princesstree, Paulownia tomentosa N/A Scrophulariales: Scrophulariaceae.

Dispersal (Questions 18 - 20)

18. Are the plant's propagules frequently dispersed long distance (>100 m) by mammals or birds or via domestic animals?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

This species typically disperses seed via wind or water.

Reference(s):

- Innes, R. J. (2009). Paulownia tomentosa.
- The University of Georgia Center for Invasive Species and Ecosystem Health (2017). princesstree, Paulownia tomentosa N/A Scrophulariales: Scrophulariaceae.
- Southeast Exotic Pest Plant Council (2017). Princess Tree, Paulownia tomentosa - Southeast Exotic Pest Plant Council Invasive Plant Manual.

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19. Are the plant's propagules frequently dispersed long distance (>100 m) by wind or water?

- Answer: **Yes**, which contributes **1** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

"One tree is capable of producing twenty million seeds that are easily transported in water or wind."

Reference(s):

- Southeast Exotic Pest Plant Council (2017). Princess Tree, Paulownia tomentosa - Southeast Exotic Pest Plant Council Invasive Plant Manual.

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20. Are the plant's propagules frequently dispersed via contaminated seed (agriculture or wildflower packets), equipment, vehicles, boats or clothing/shoes?

- Answer: **No**, which contributes **0** points to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Lack of evidence

Reference(s):

- [Anonymous] .

Total PRE Score

PRE Score: 16 -- Reject (high risk of invasiveness)
Confidence: 60 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

PRE Score Legend

The PRE Score is calculated by adding the point totals for each (answered) question.
< 13 : accept (low risk of invasiveness)
13 - 15 : evaluate further
> 15 : reject (high risk of invasiveness)

Questions Answered Legend

It is important to answer at least 16 questions to consider a PRE Score as "valid".
>= 16 : valid (80% or more questions answered)
<= 15 : invalid (not enough questions answered)

Organization Ownership and Content Privacy

Organization: 2017 Farm Bill PRE Project
Content Privacy: Public

Evaluation Reviewers

The PRE approach is to base decisions on science and make decisions by consensus of diverse horticultural stakeholders. The literature review and process of answering PRE's questions are based on science; the decisions of which plants to prioritize are based on consensus. To ensure this process is in place and that PRE is collaborative, volunteer stakeholders are recruited from each region to review evaluations. The following experts in their profession (plant science, conservation, or horticultural trade) have participated as volunteer PRE reviewers for this evaluation:

- Shelly Matthew Prescott January 4, 2018

This evaluation has a total of 1 reviewer(s).

Evaluation Issues

The following section lists all public issues for this evaluation. Issues provide a way for stakeholder reviewers to communicate any concerns or suggestions they might have with the plant or evaluation. Please email PlantRight@suscon.org if additional action is required to resolve open issues.

There are currently no issues associated with this evaluation.

About PRE and this Plant Evaluation Report

The PlantRight Plant Risk Evaluator -- PRE is an online database and platform enabling those involved in non-native, terrestrial plant production to know before they grow if a plant poses a regional invasive risk. This tool offers many benefits, and we encourage you to visit the PRE website (https://pre.ice.ucdavis.edu) for more information.

If you are a nursery trade association, or involved in the research, development or distribution of horticultural plants we invite you to join the PRE community. If you are a plant scientist, affiliated with a horticultural college or botanic garden, and would like to learn more about becoming a PRE Screener, please drop us an email, PlantRight@suscon.org, requesting a PRE Account.

PRE beta funding is provided by Sustainable Conservation (http://www.suscon.org/) and a USDA Farm Bill grant.