Plant Risk Evaluator -- PRE™
Evaluation Report

Tilia cordata 'PNI 6025' GREENSPIRE -- Illinois

2017 Farm Bill PRE Project

PRE Score: 6 -- Accept (low risk of invasiveness)
Confidence: 60 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

Privacy: Public
Status: Submitted

Evaluation Date: April 5, 2017

This PDF was created on June 15, 2018

Plant Evaluated

Tilia cordata 'PNI 6025' GREENSPIRE

Image by Chicago Botanic Garden

Evaluation Overview

A PRE™ screener conducted a literature review for this plant (*Tilia cordata 'PNI 6025' GREENSPIRE*) 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.

General Information

Status: Submitted
Screener: Emily Russell
Evaluation Date: April 5, 2017

Plant Information

Plant: *Tilia cordata 'PNI 6025' GREENSPIRE*

If the plant is a cultivar, how does its behavior differs from its parent's?
The cultivar 'Greenspire' was introduced by Princeton Nurseries in 1961. The name 'Greenspire' was registered as a trademark in 1974, so the correct cultivar name is 'PNI 6025.' It was selected for its dense, formal pyramidal habit. Compared to the species, it has a narrower crown, is slightly shorter (reaching 50 feet tall rather than 70 feet) and is said to have a faster growth rate. There is no evidence that 'Greenspire' is significantly different than the species in reproductive traits.

Regional Information

Region Name: Illinois

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 **Medium** confidence in this answer based on the available literature.

Answer / Justification:

The species Tilia cordata has become naturalized in the Mid-Atlantic United States and Ontario, Canada. It can be inferred that the cultivar 'Greenspire' has contributed to this naturalization since it has been widely planted for many years. The University of Florida IFAS Extension notes: "this cultivar of littleleaf linden is more popular than the species or any of the other cultivars." 'Greenspire' was introduced in 1961, and was selected for its dense, formal pyramidal habit. There is no evidence that it is significantly different than the species in reproductive traits.

Reference(s):

- USDA NRCS (2017). USDA PLANTS Database: Tilia cordata Mill..
- Watson, D. G. and Edw (2015). Tilia cordata 'Greenspire'. 2017,

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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:

The species Tilia cordata has become naturalized in the Mid-Atlantic United States where there is a similar climate to Illinois. It can be inferred that the cultivar 'Greenspire' has contributed to this naturalization since it is widely planted and there is no evidence that it is significantly different than the species in reproductive traits.

Reference(s):

- USDA NRCS (2017). USDA PLANTS Database: Tilia cordata Mill..

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

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

Answer / Justification:

Tilia cordata 'Greenspire' is not noted as being invasive; neither is the species.

Reference(s):

- [Anonymous] .

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

Answer / Justification:

Tilia cordata 'Greenspire' is not noted as being invasive; neither is the species.

Reference(s):

- [Anonymous] .

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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 **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Tilia platyphyllos is listed as naturalized and an established alien in Scandinavia and some parts of northern Europe, but there is not evidence of significant damage.

Reference(s):

- Randall, R. (2012). A Global Compendium of Weeds. 2nd Edition..
- DAISIE (2008). DAISIE European Alien Species Gateway: Tilia platyphyllos.

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

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

Answer / Justification:

About half of the native distribution of Tilia cordata in Europe matches the climate of Illinois. GBIF also shows some sparse introduced distributions in western North America and Australia which do not match the climate of Illinois. Tilia cordata 'Greenspire' is widely planted and adaptable to urban conditions and a wide range of soil types.

Reference(s):

- GBIF Secretariat (2016). GBIF Backbone Taxonomy: Tilia cordata Mill..
- Watson, D. G. and Edw (2015). Tilia cordata 'Greenspire'. 2017,

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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: **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:

There is a lack of evidence that Tilia cordata 'Greenspire' dominates plant communities where it is established.

Reference(s):

- [Anonymous] .

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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 **Medium** confidence in this answer based on the available literature.

Answer / Justification:

There is no evidence that Tilia cordata 'Greenspire' changes fire regimes.

Reference(s):

- [Anonymous] .

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:

Tilia flowers are harvested and used for tea, though they can develop narcotic properties as they age. Tilia cordata nectar is popular with bees but contains trace amounts of nicotine which are usually not harmful. There are reports of other species of Tilia nectar being toxic to bees.

Reference(s):

- Pawlikowski, T.. (2010). Pollination activity of bees (Apoidea: Apiformes) visiting the flowers of Tilia cordata Mill. and Tilia tomentosa Moench in an urban environment. Journal of Apicultural Science. 2,
- Singaravelan, N., Inbar M., Ne'eman G., Distl M., Wink M., & Izhaki I. (2006). The Effects of Nectar–Nicotine on Colony Fitness of Caged Honeybees. Journal of Chemical Ecology. 32, 49–59.
- Plants For A Future (PFAF) (2012). Tilia cordata Small Leaved Lime, Littleleaf linden PFAF Plant Database.

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 **Low** confidence in this answer based on the available literature.

Answer / Justification:

There is a lack of evidence Tilia cordata 'Greenspire' produces thickets.

Reference(s):

- [Anonymous] .

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 **High** confidence in this answer based on the available literature.

Answer / Justification:

Horticulturists note that Tilia cordata 'Greenspire' has frequent basal suckering and is a good subject for coppicing and pollarding. In its native forest settings, Tilia cordata "strongly spreads through clump shoots and root suckering."

Reference(s):

- Watson, D. G. and Edw (2015). Tilia cordata 'Greenspire'. 2017,
- Kimberley, M. (2015). Tilia. 2017,
- De Jaegere, T., Hein S., & Claessens H. (2016). A Review of the Characteristics of Small-Leaved Lime (Tilia cordata Mill.) and Their Implications for Silviculture in a Changing Climate. Forests. 7, 56.
- Radoglou, K., Dobrowolska D., Spyroglou G., & Nicolescu V-N. (2008). A review on the ecology and silviculture of limes (Tilia cordata Mill., Tilia platyphyllos Scop. and Tilia tomentosa Moench.) in Europe.. Romania. 15, 16.

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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: **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:

Fragmentation is not documented as a common method of reproduction for Tilia cordata.

Reference(s):

- [Anonymous] .

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 **Medium** confidence in this answer based on the available literature.

Answer / Justification:

The species Tilia cordata commonly produces viable seed. In the nursery trade, Tilia cordata 'Greenspire' is usually propagated by grafting or budding, not seed. Seed viability studies are not available for the cultivar Tilia cordata 'Greenspire.' Overall, there is no evidence that Tilia cordata 'Greenspire' is different than the species in producing viable seed.

Reference(s):

- USDA Forest Service (2008). USDA FS Agriculture Handbook 727 - The Woody Plant Seed Manual.
- De Jaegere, T., Hein S., & Claessens H. (2016). A Review of the Characteristics of Small-Leaved Lime (Tilia cordata Mill.) and Their Implications for Silviculture in a Changing Climate. Forests. 7, 56.

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 **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Tilia cordata trees can produce 150,000 seeds in poor years and up to 1,000,000 seeds in mast years. However, the viability varies widely based on age, nutrient availability, and climate with colder climates producing less viable seed. Generally, the percentage of empty fruits is estimated at around 40% but can reach 100% on the northern edge of its range. Seed viability studies are not available for the cultivar Tilia cordata 'Greenspire,' however there is no evidence that Tilia cordata 'Greenspire' is different than the species in producing viable seed.

Reference(s):

- De Jaegere, T., Hein S., & Claessens H. (2016). A Review of the Characteristics of Small-Leaved Lime (Tilia cordata Mill.) and Their Implications for Silviculture in a Changing Climate. Forests. 7, 56.
- Radoglou, K., Dobrowolska D., Spyroglou G., & Nicolescu V-N. (2008). A review on the ecology and silviculture of limes (Tilia cordata Mill., Tilia platyphyllos Scop. and Tilia tomentosa Moench.) in Europe.. Romania. 15, 16.

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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:

Generally, seeds of Tilia cordata do not germinate for two years. Delayed germination is caused by a tough pericarp, an impermeable seedcoat, and a dormant embryo. There is no evidence that Tilia cordata 'Greenspire' seeds germinate at a different rate than the species.

Reference(s):

- USDA Forest Service (2008). USDA FS Agriculture Handbook 727 - The Woody Plant Seed Manual.
- De Jaegere, T., Hein S., & Claessens H. (2016). A Review of the Characteristics of Small-Leaved Lime (Tilia cordata Mill.) and Their Implications for Silviculture in a Changing Climate. Forests. 7, 56.

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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 **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Tilia cordata "usually flowers within 5 to 15 years when grown from seed." There is no evidence that Tilia cordata 'Greenspire' produces seed at a different age than the species.

Reference(s):

- USDA Forest Service (2008). USDA FS Agriculture Handbook 727 - The Woody Plant Seed Manual.

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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 **Medium** confidence in this answer based on the available literature.

Reference(s):

- USDA Forest Service (2008). USDA FS Agriculture Handbook 727 - The Woody Plant Seed Manual.

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 **Low** confidence in this answer based on the available literature.

Answer / Justification:

Tilia seeds can be eaten by mice and voles.

Reference(s):

- Radoglou, K., Dobrowolska D., Spyroglou G., & Nicolescu V-N. (2008). A review on the ecology and silviculture of limes (Tilia cordata Mill., Tilia platyphyllos Scop. and Tilia tomentosa Moench.) in Europe.. Romania. 15, 16.

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

- 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:

Tilia cordata seeds are primarily dispersed by wind, and can be blown a few hundred meters, though most fall close to the parent tree. Fruits and their bracts can float for a long time and be carried up to 30km, but dispersal by water is rare in its native habitats.

Reference(s):

- De Jaegere, T., Hein S., & Claessens H. (2016). A Review of the Characteristics of Small-Leaved Lime (Tilia cordata Mill.) and Their Implications for Silviculture in a Changing Climate. Forests. 7, 56.
- Radoglou, K., Dobrowolska D., Spyroglou G., & Nicolescu V-N. (2008). A review on the ecology and silviculture of limes (Tilia cordata Mill., Tilia platyphyllos Scop. and Tilia tomentosa Moench.) in Europe.. Romania. 15, 16.

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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 **Low** confidence in this answer based on the available literature.

Answer / Justification:

There is no evidence of accidental human dispersal of Tilia cordata 'Greenspire.'

Reference(s):

- [Anonymous] .

Total PRE Score

PRE Score: 6 -- Accept (low 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:

• Steve Worth	December 22, 2017
• Michael Yanny	December 6, 2017
• Kim Shearer	October 14, 2017

This evaluation has a total of 3 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.