Plant Risk Evaluator -- PRE™
Evaluation Report

Euonymus alatus 'Compactus' -- Minnesota

2017 Farm Bill PRE Project

PRE Score: 15 -- Evaluate this plant further
Confidence: 58 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

Privacy: Public
Status: Completed

Evaluation Date: March 22, 2017

This PDF was created on June 15, 2018

Plant Evaluated

Euonymus alatus 'Compactus'

Image by Missouri Botanical Garden

Evaluation Overview

A PRE™ screener conducted a literature review for this plant (*Euonymus alatus 'Compactus'*) 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

Euonymus alatus 'Compactus' is a popular clonal selection of winged burning bush and is commonly used as an ornamental landscape plant thorughout much of the eastern and midwestern United States. Seeds of winged burning bush are consumed and dispersed by birds and it has naturalized and become invasive in many areas where it has been planted. The species forms dense thickets, displacing many native woody and herbaceous plant species. The cultivar 'Compactus' is currently grown and sold as a landscape plant in Minnesota and appears to be well-adapted to Minnesota's climate. Winged burning bush seedlings are occurring commonly in wooded areas at the University of Minnesota Landscape Arboretum and have been reported at other wooded locations in Minnesota. There is little information on the invasive potential of this cultivar 'Compactus' specifically, but research has shown that, like the species, it is capable of producing large quantities of viable seed. Based on the invasive tendency of the species and the absence of any fundamental difference between the species and the cultivar 'Compactus' in terms of biological traits that contribute to invasiveness, the cultivar warrants additional observation and evaluation of its potential to become invasive in Minnesota.

General Information

Status: Completed
Screener: Steve McNamara
Evaluation Date: March 22, 2017

Plant Information

Plant: *Euonymus alatus 'Compactus'*

Regional Information

Region Name: Minnesota

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

Answer / Justification:

The species is found from New England to northern Florida, west to Iowa and Missouri and north to Wisconsin and Minnesota as well as Montana. There is currently no evidence linking naturalized or invasive plants directly to the cultivar 'Compactus'. However, because 'Compactus' possesses the biological attributes of the species that promote spread and reproduction (plant habit, growth rate, fecundity, seed morphology, etc.), it is reasonable to infer that it will have similar potential for naturalization where it is not native.

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (0). Winged burning bush (Euonymus alatus) - EDDMapS State Distribution.
- Swearingen, J., & Bargeron C. (0). Winged burning bush: Euonymus alatus (Celastrales: Celastraceae): Invasive Plant Atlas of the United States.
- United States Department of Agriculture (2014). USDA-NRCS Plants Database (Euonymus alatus).
- Kartesz, J. T. (2015). The Biota of North America Program (BONAP).
- Ebinger, J., Newman J., & Nyboer R. (1984). Naturalized Winged Wahoo in Illinois. Natural Areas Journal. 4, 26–29.
- Farrar, D. R. (2001). Exotic and Invasive Woody Plant Species in Iowa. The Journal of the Iowa Academy of Science. 108, 154–157.
- Mehrhoff, L.. J., Jr. J.. A. Silande, Leight S.. A., Mosher E.. S., & Tabak N.. M. (2003). IPANE: invasive plant atlas of New England.

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

Answer / Justification:

The species is on the Wisconsin DNR's restricted plant list and has been found naturalizing in Minnesota as well as Montana. We are beginning to find seedlings growing in the forest understory at the University of Minnesota Landscape Arboretum. As noted in 1., there is currently no evidence linking naturalized plants in these area directly to the cultivar 'Compactus, but it is reasonable to infer that similar biological attributes would confer a similiar propensity for naturalizing.

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (0). Winged burning bush (Euonymus alatus) - EDDMapS State Distribution.
- Kartesz, J. T. (2015). The Biota of North America Program (BONAP).
- Wisconsin Department of Natural Resources (0). Winged euonymus, burning bush - Wisconsin DNR.
- Hoffman, R., & Kearns K. (1997). Wisconsin Manual of Control Recommendations for Ecologically Invasive Plants.
- Midwest Invasive Plant Network (2015). Midwest Invasive Plant List.

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

Answer / Justification:

The species is invasive throughout much of New England and the southwestern and midwestern United States. However, there is limited evidence directly relating this spread to the cultivar 'Compactus'. Finneseth et al. state that 'Compactus' is recognized as the main source of invasive Euonymus alatus plants, but cite no supporting evidence for this statement. However, the cultivar Compactus' exhibits exhibits a majority of biological attributes of the species from which it was selected and, consequently, could be expected to demonstrate similar invasive tendencies.

Reference(s):

- Miller, J. H. (2003). Winged Burning Bush - Nonnative Invasive Plants of Southern Forests - A Field Guide for Identification and Control Gen. Tech. Rep. SRS–62 USDA Forest Service.
- Miller, J. H., Chambliss E. B., & Bargeron C. T. (2016). Invasive Plants of the Thirteen Southern States.
- Finneseth, C., Geneve R., & Dunwell W. (2007). Fruit Production in ‘Compactus’ and ‘Rudy Haag’ Burning Bush.
- Swearingen, J., Slattery B., Reshetiloff K., & Zwicker S. (2010). Plant Invaders of Mid-Atlantic Natural Areas. 168.
- Farrar, D. R. (2001). Exotic and Invasive Woody Plant Species in Iowa. The Journal of the Iowa Academy of Science. 108, 154–157.

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

Answer / Justification:

Euonymus alatus is on the restricted plant list of Wisconsin,but all cultivars except 'Nordine' are currently exempt.

Reference(s):

- Wisconsin Department of Natural Resources (0). Winged euonymus, burning bush - Wisconsin DNR.
- The University of Georgia Center for Invasive Species and Ecosystem Health (0). Winged burning bush (Euonymus alatus) - EDDMapS State Distribution.
- Swearingen, J., & Bargeron C. (0). Winged burning bush: Euonymus alatus (Celastrales: Celastraceae): Invasive Plant Atlas of the United States.

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

- Answer: **Yes**, 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:

The species Euonymus alatus is on the Wisconsin DNR's restricted species plant list. Other species such as E. europaeus and E. fortunei are problematic in warmer regions of the United States, but I found no reports in the literature of these species being invasive in colder regions comparable to Minnesota.

Reference(s):

- The University of Georgia Center for Invasive Species and Ecosystem Health (2017). Winter creeper (Euonymus fortunei) - EDDMapS State Distribution.
- Hawaiian Ecosystems at Risk project (HEAR) (0). Global Compendium of Weeds: species index.
- United States Department of Agriculture (0). USDA-NRCS PLANTS Databse (Euonymus sp.).
- Midwest Invasive Plant Network (2015). Midwest Invasive Plant List.

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

Answer / Justification:

The species is on the Wisconsin DNR's restricted list and there are reports of it naturalizing in Minnesota. However, neither the native range of the species nor the vast majority of the regions of the United States where it has been utilized as a landscape plant and has now become naturalized/invasive (i.e. the Northeast, the Mid-Atlantic, and Midwestern regions) have climates matching Minnesotas. This would be true for the cultivar 'Compactus' as well.

Reference(s):

- GBIF (0). Global Biodiversity Information Facility (GBIF).
- The University of Georgia Center for Invasive Species and Ecosystem Health (0). Winged burning bush (Euonymus alatus) - EDDMapS State Distribution.
- Wisconsin Department of Natural Resources (0). Winged euonymus, burning bush - Wisconsin DNR.

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

Answer / Justification:

The species is known to crowd out native plants once it becomes established. There is currently no evidence proving plants at known invasion sites were derived from 'Compactus', but because 'Compactus' possesses the biological attributes of the species that promote spread and reproduction (plant habit, growth rate, fecundity, seed morphology, etc.), it is reasonable to infer that it or its seedlings will have similar potential for crowding out native plants.

Reference(s):

- Swearingen, J., Slattery B., Reshetiloff K., & Zwicker S. (2010). Plant Invaders of Mid-Atlantic Natural Areas. 168.
- Invasive Species Specialist Group (0). Global Invasive Species Database - Euonymus alata.
- Rhoads, A. F., & Block T. A. (2002). Invasive species fact sheet: Winged euonymus–(burning-bush, winged wahoo, winged spindle-tree, Japanese spindle-tree.

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

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

Answer / Justification:

There is some discussion in the literature that because the species can form dense thickets and can resprout vigorously when cut, it could potentially contribute to the fire load of forested areas.

Reference(s):

- Dibble, A. C., Zouhar K., & Smith J. Kapler (2008). Fire and Nonnative Invasive Plants in the Northeast Bioregion.
- Fryer, J. L. (2009). Euonymus alatus - Fire Effects Information System.

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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: **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:

All parts of Euonymus alatus 'Compactus' are reportedly toxic to humans and animals if ingested in large quantities.

Reference(s):

- NC State Extension (0). Euonymus alatus 'Compactus'.
- Royal Horticultural Society (2017). Euonymus alatus 'Compactus' (Compact winged spindle tree) - RHS Gardening.

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

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

Answer / Justification:

The species can produce dense thickets once an area becomes heavily infested. There is no evidence for this specific cultivar doing so, but it seems reasonable to assume that seedlings derived from this cultivar would likely behave like the species.

Reference(s):

- Swearingen, J., Slattery B., Reshetiloff K., & Zwicker S. (2010). Plant Invaders of Mid-Atlantic Natural Areas. 168.
- Ebinger, J., Newman J., & Nyboer R. (1984). Naturalized Winged Wahoo in Illinois. Natural Areas Journal. 4, 26–29.
- Rhoads, A. F., & Block T. A. (2002). Invasive species fact sheet: Winged euonymus–(burning-bush, winged wahoo, winged spindle-tree, Japanese spindle-tree.

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:

The cultivar 'Compactus', like the species, can spread slowly by suckering.

Reference(s):

- Miller, J. H. (2003). Winged Burning Bush - Nonnative Invasive Plants of Southern Forests - A Field Guide for Identification and Control Gen. Tech. Rep. SRS–62 USDA Forest Service.
- Maryland Department of Agriculture (2015). Weed Risk Assessment for Euonymus alatus (Thunb.) Siebold (Celastraceae) – winged burning bush.

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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:

I can find no information in the literature indicating that either the species or the cultivar 'Compactus' commonly reproduce via detached fragments.

Reference(s):

- [Anonymous] .

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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:

The species itself commonly producus large quantities of viable seed. The cultivar 'Compactus' was among the most fecund of the burning bush cultivars evaluated by Brand et al. (Cite paper referring to the seed shadow under established plants.)

Reference(s):

- Brand, M. H., Lubell J. D., & Lehrer J. M. (2012). Fecundity of Winged Euonymus Cultivars and Their Ability to Invade Various Natural Environments. HortScience. 47, 1029–1033.
- Swearingen, J., Slattery B., Reshetiloff K., & Zwicker S. (2010). Plant Invaders of Mid-Atlantic Natural Areas. 168.

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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:

Individual plants of Euonymus alatus 'Compactus' have been reported to produce > 1000 seeds in several studies.

Reference(s):

- Brand, M. H., Lubell J. D., & Lehrer J. M. (2012). Fecundity of Winged Euonymus Cultivars and Their Ability to Invade Various Natural Environments. HortScience. 47, 1029–1033.
- Finneseth, C., Geneve R., & Dunwell W. (2007). Fruit Production in ‘Compactus’ and ‘Rudy Haag’ Burning Bush.

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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: **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:

Germination percentages > 25% have been reported for seed of 'Compactus'.

Reference(s):

- Ranney, T. G., Eaker T. A., & Mowrey J. A. (2007). Assessing Fertility among Cultivars of Winged Euonymus. Procceedings of the Southern Nursery Conference. 52, 352–354.
- Brand, M. H., Lubell J. D., & Lehrer J. M. (2012). Fecundity of Winged Euonymus Cultivars and Their Ability to Invade Various Natural Environments. HortScience. 47, 1029–1033.

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

Answer / Justification:

Brand et al. reported high levels of seed production on 6-year-old plants. It seems reasonable to assume that these same plants were likely flowering and setting seed to some degree the previous year as 5-year-old plants.

Reference(s):

- Brand, M. H., Lubell J. D., & Lehrer J. M. (2012). Fecundity of Winged Euonymus Cultivars and Their Ability to Invade Various Natural Environments. HortScience. 47, 1029–1033.

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

Answer / Justification:

Euonymus alatus 'Compactus' seed ripens in the fall and have typically fallen or been consumed within several months of ripening.

Reference(s):

- Dirr, M. (2009). Manual of woody landscape plants: their identification, ornamental characteristics, culture, propagation, and uses.

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: **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:

Birds are known to consume seed of the species which would facilitate long distance dispersal of the seeds. No data is specifically reported for the cultivar 'Compactus' but it is reasonable to assume seeds of this cultivar are also spread by birds.

Reference(s):

- Maryland Department of Agriculture (2015). Weed Risk Assessment for Euonymus alatus (Thunb.) Siebold (Celastraceae) – winged burning bush.
- Swearingen, J., Slattery B., Reshetiloff K., & Zwicker S. (2010). Plant Invaders of Mid-Atlantic Natural Areas. 168.

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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:

I found no mention in the literature that either wind or water play a significant role in dispersing propagules of Euonymus alatus.

Reference(s):

- [Anonymous] .

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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:

Based on its size, Euonymus alatus seed could conceivably be spread via adherence to vehicle tires. There is some evidence that the sspecies spreads along roadways through forested areas in Indiana. However, birds that consume the fruit and follow the road corridors through these forests could be the primary agent for spreading this seed. I found no information indicating that seed of the species or cultivar is frequently transported via any of the means mentioned above.

Reference(s):

- S. Flory, L., & Clay K. (2006). Invasive shrub distribution varies with distance to roads and stand age in eastern deciduous forests in Indiana, USA. Plant Ecology. 184, 131–141.

Total PRE Score

PRE Score: 15 -- Evaluate this plant further
Confidence: 58 / 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:

• Angelique Dahlberg	December 2, 2017
• Tom Buechel	November 9, 2017

This evaluation has a total of 2 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.