Plant Risk Evaluator -- PRE™
Evaluation Report

Dimorphotheca sinuata -- Arizona

2021 Western IPM Grant Project

PRE Score: 12 -- Low Potential Risk
Confidence: 66 / 100
Questions answered: 20 of 20 -- Valid (80% or more questions answered)

Privacy: Public
Status: Completed

Evaluation Date: September 15, 2021

This PDF was created on September 06, 2024

This project was funded in part by the USDA National Institute of Food and Agriculture through the Western Integrated Pest Management Center, grant number 2018-70006-28881.

Plant Evaluated

Dimorphotheca sinuata

Image by Arto Alanenpää

Evaluation Overview

A PRE™ screener conducted a literature review for this plant (*Dimorphotheca sinuata*) 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

Dimorphotheca sinuata is an annual wildflower native to Namibia and South Africa that has been widely commercialized as an ornamental for its attractive and colorful flowers. The flowers are a popular annual to seed into gravel yards in southern Arizona, where it can regularly be seen filling yards. It has escaped cultivation and may be found naturalized in open and disturbed sites. The winged seeds have no obvious adaptation to animal dispersal and are presumed dispersed by wind.

General Information

Status: Completed
Screener: Michael Chamberland
Evaluation Date: September 15, 2021

Plant Information

Plant: *Dimorphotheca sinuata*

Regional Information

Region Name: Arizona

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.

Evaluation Questions

These questions are based on an article published by PLOS One, which can be found 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** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

Dimorphotheca sinuata is an annual wildflower native to Namibia and South Africa that has been widely commercialized as an ornamental for its attractive and colorful flowers (Dave's Garden, 2021). It has escaped cultivation and often can be found naturalized in open and disturbed sites (Rojas-Sandoval, 2020). The plant is adapted to arid environments, and is known to naturalize in Arizona (Martin, 2021), (Kinsey, 2021). It is found in 18 counties in California, chiefly in southern California (Calflora, 2021).

Reference(s):

- Dave's Garden (2021). Dimorphotheca Species, African Daisy, Cape Marigold, Namaqualand Daisy, Sun Marigold.
- Rojas-Sandoval, J. (2020). Dimorphotheca sinuata. CABI Invasive Species Compendium.
- Martin, C. (2021). Dimorphotheca sinuata.
- Kinsey, B. (2021). Dimorphotheca sinuata - Southeastern Arizona Wildflowers and Plants.
- Calflora (2021). Calflora - Dimorphotheca sinuata.

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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** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

The plant is adapted to arid environments, and is known to naturalize in Arizona (Martin, 2021), (Kinsey, 2021), this matches with the native habitat in southern Africa, as well as introduced occurrences in southern California (Calflora, 2021) and Australia (GBIF, 2021).

Reference(s):

- Martin, C. (2021). Dimorphotheca sinuata.
- Kinsey, B. (2021). Dimorphotheca sinuata - Southeastern Arizona Wildflowers and Plants.
- Calflora (2021). Calflora - Dimorphotheca sinuata.
- GBIF (2021). Dimorphotheca sinuata DC.. GBIF—the Global Biodiversity Information Facility.

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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** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

CABI Invasive Species Compendium notes Dimorphotheca sinuata has been naturalized in many parts of the world, It is listed as invasive only in the Dominican Republic but it is also regarded as an emerging environmental weed in Australia and California (Rojas-Sandoval, 2020). CABI differentiates between "naturalized" and "invasive" which lends weight to the statement of this species as invasive. Nevertheless, an occurrence in Dominican Republic is not shown in GBIF (2021), and this reduces the confidence to "Medium".

Reference(s):

- Rojas-Sandoval, J. (2020). Dimorphotheca sinuata. CABI Invasive Species Compendium.
- GBIF (2021). Dimorphotheca sinuata DC.. GBIF—the Global Biodiversity Information Facility.

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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** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

CABI Invasive Species Compendium notes Dimorphotheca sinuata is listed as invasive only in the Dominican Republic (Rojas-Sandoval, 2020). The Caribbean Region is not a similar climate to southern Africa, and this occurrence is not shown in GBIF (2021) which reduces confidence of this report.

Reference(s):

- Rojas-Sandoval, J. (2020). Dimorphotheca sinuata. CABI Invasive Species Compendium.
- GBIF (2021). Dimorphotheca sinuata DC.. GBIF—the Global Biodiversity Information Facility.

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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** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Calflora records Dimorphotheca fruticosa as naturalized in southern California (Calflora, 2021). Dimorphotheca tragus and D. pluvialis are other species of Dimorphotheca native to southern Africa, and shown as occurring in the American Southwest. The latter is also shown as occurring in the matching climate of Australia (GBIF, 2021). However the occurrences of these species appear to be naturalized rather than invasive.

Reference(s):

- GBIF (2021). Dimorphotheca sinuata DC.. GBIF—the Global Biodiversity Information Facility.
- Calflora (2021). Calflora - Dimorphotheca sinuata.

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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** point(s) to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

Occurrences shown by GBIF are predominantly in matching climates of the American Southwest and Australia. Other occurrences are scattered in other parts of Africa, North America, and Europe (GBIF, 2021).

Reference(s):

- GBIF (2021). Dimorphotheca sinuata DC.. GBIF—the Global Biodiversity Information Facility.

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** point(s) to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

There is no information concerning this plant's abilities to compete in non-native situations. Many studies were available describing its competitive abilities intraspecifically, or interspecifically within its native environment (Halvorson & Guertin, 2003). By inference, the small stature and annual habit of the plant render it unlikely to have a smothering effect on plant communities, however it might compete with other annual wildflowers sharing the same winter-growing habit.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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

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

Answer / Justification:

No information is available on the plant's potential to support fire. Its small stature and low biomass (Dave's Garden, 2021) do not suggest much potential.

Reference(s):

- Dave's Garden (2021). Dimorphotheca Species, African Daisy, Cape Marigold, Namaqualand Daisy, Sun Marigold.

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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** point(s) to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Parts of plant are poisonous if ingested (Dave's Garden, 2021). However this information is not elaborated elsewhere, so the claim is questionable. The small size and annual growth habit of the plant make it unlikely to impact grazing systems.

Reference(s):

- Dave's Garden (2021). Dimorphotheca Species, African Daisy, Cape Marigold, Namaqualand Daisy, Sun Marigold.

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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** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

The plant is a low-growing herbaceous annual, growing to 12 inches tall (Halvorson & Guertin, 2003), too small to form thickets or impediments.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

Reproductive Strategies (Questions 11 - 17)

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

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

Answer / Justification:

The plant is an herbaceous annual which reproduces by seed. Vegetative propagation is not noted (Dave's Garden, 2021). Being an annual, all vegetative growth will die at the end of the growing season, limiting any capacity for vegetative proliferation.

Reference(s):

- Dave's Garden (2021). Dimorphotheca Species, African Daisy, Cape Marigold, Namaqualand Daisy, Sun Marigold.

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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** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

A capacity for vegetative propagation is not noted (Dave's Garden, 2021). Being an annual, all vegetative growth will die at the end of the growing season, limiting any capacity for vegetative proliferation.

Reference(s):

- Dave's Garden (2021). Dimorphotheca Species, African Daisy, Cape Marigold, Namaqualand Daisy, Sun Marigold.

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

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

Answer / Justification:

Dimorphotheca sinuata produces dimorphic fruits (two different achenes/seeds). These achenes/seeds are morphologically and anatomically different, with each having different responses to environmental conditions, ensuring species' survival. Seeds tend to drop from the plant as soon as they are mature. Achenes of the disc flowers are winged, having better dispersal mechanisms than achenes of the ray flowers, which are non-winged (Halvorson & Guertin, 2003).

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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

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

Answer / Justification:

The plant is an annual usually no more than 12 inches tall (Halvorson & Guertin, 2003), with large flowers somewhat limited in number due to the expense of producing them. By inference, one plant is unlikely to produce 1000 seeds.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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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** point(s) to the total PRE score.
- The *screener* has a **High** confidence in this answer based on the available literature.

Answer / Justification:

Seeds of various ages were germinated in laboratory conditions at 59°F (15°C) in germination blotters, germination ranged between 54-73% for seeds less than a year old, 71-84% after 6 years of storage, 71-84% after 11 years, 71-80% after 16 years. Seeds were stored at 41°F (5°C) and at 40% relative humidity (Halvorson & Guertin, 2003). Confidence is rated as "High" but not "Very High" because these were laboratory tests rather than field tests.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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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** point(s) to the total PRE score.
- The *screener* has a **Very High** confidence in this answer based on the available literature.

Answer / Justification:

The plant is an annual, producing seeds by the end of the growing season within one year (Halvorson & Guertin, 2003).

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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

Answer / Justification:

The Jepson eFlora lists the flowering time Feb--Jun (Keil, 2012), which is greater than a three month period and warrants a yes. However phenology statements such as this in floristic works usually refer to the flowering period of the species across its range, and not the flowering period for an individual plant. The plant is an annual with a single seed production period at the end of the growing season (Halvorson & Guertin, 2003). More information is needed to determine if the flowering period mentioned in the Jepson eFlora reflects seed production for individuals or groups of individuals within a population.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.
- Keil, D. J. (2012). Jepson Manual; Dimorphotheca sinuata. Dimorphotheca sinuata, in Jepson Flora Project (eds.) Jepson eFlora.

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** point(s) to the total PRE score.
- The *screener* has a **Medium** confidence in this answer based on the available literature.

Answer / Justification:

Seeds tend to drop from the plant. Achenes of the disc flowers are winged, having better dispersal mechanisms than achenes of the ray flowers, which are non-winged (Halvorson & Guertin, 2003). The winged seeds are adapted to wind dispersal. There appear to be no adaptations for dispersal by mammals or birds.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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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** point(s) to the total PRE score.
- The *screener* has a **Low** confidence in this answer based on the available literature.

Answer / Justification:

Achenes of the disc flowers are winged, having better dispersal mechanisms than achenes of the ray flowers, which are non-winged (Halvorson & Guertin, 2003). The winged seeds are adapted for wind dispersal. However because of the low stature of the plants, by inference it is unlikely these seeds regularly have long-distance dispersal capacity of 100 meters or more.

Reference(s):

- Halvorson, W. L., & Guertin P. (2003). Dimorphotheca sinuata D.C.. USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. 14.

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

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

Answer / Justification:

Dimorphotheca sinuata has been widely commercialized as an ornamental for its attractive and colorful flowers (Dave's Garden, 2021). It has escaped cultivation and often can be found naturalized in open and disturbed sites (Rojas-Sandoval, 2020). It is highly likely to be transported internationally deliberately (Rojas-Sandoval, 2020). The seeds are sold, either pure or within flower seed mixtures, by such high-profile companies as High Country Gardens (2022), True Leaf Market (2022) and Urban Farmer (2022). The Tucson-based company "The Native Seed Company" (2022) sells packets of pure daisy seed. I have interpreted the presence of Dimophotheca seeds in flower seed mixtures as equivalent of contaminated seed, even if their presence is intentional.

Reference(s):

- Dave's Garden (2021). Dimorphotheca Species, African Daisy, Cape Marigold, Namaqualand Daisy, Sun Marigold.
- Rojas-Sandoval, J. (2020). Dimorphotheca sinuata. CABI Invasive Species Compendium.
- High Country Gardens (2022). African Daisy Seeds.
- Market, T. Leaf (2022). Dimorphotheca Seeds - Mixed Colors.
- Farmer, U. (2022). Oklahoma Blend, Wildflower Seed.
- Company, N. Seed (2022). Pure Daisy.

Total PRE Score

PRE Score: 12 -- Low Potential Risk
Confidence: 66 / 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 : Low Potential Risk
13 - 15 : Moderate Potential Risk
> 15 : High Potential Risk

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: 2021 Western IPM Grant 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:

• Michael Chamberland	March 7, 2022
• Rebecca Senior	January 4, 2022
• Nicole Valentine	October 19, 2021
• Lynn Sweet	October 18, 2021

This evaluation has a total of 4 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 info@plantright.org if additional action is required to resolve open issues.

Issue ID # 7419

Date Created: October 18, 2021 - 10:14pm
Date Updated: March 7, 2022 - 7:59pm

Submitted by: Lynn Sweet

Status: Fixed
Type: Suggestion
Severity: Major
Scope: Q20. Are the plant’s propagules frequently dispersed via contaminated seed, equipment, vehicles, boats or clothing/shoes?

Issue Description

Logically I see why you answered yes, but the bar for a "yes" here is higher than being in the ornamental trade or opportunity due to being introduced to many landscapes/gardens. One reason for this is that this tool was created in order to evaluate horticultural plants. So we need evidence that a common route for its introduction is because it is used in wildflower packets in or adjacent to wildlands, or is a contaminant, or that the seeds attach to clothing/vehicles which is normally how species yet a "yes" here. Otherwise it is a "no". - Lynn Sweet

Issue Resolution (Screener's Response to Issue)

I have added additional references to the incorporation of Dimorphotheca seeds into flower seed mixtures intended for outdoor gardens. I've interpreted the presence of Dimophotheca seeds in flower seed mixtures as equivalent of contaminated seed, even if their presence is intentional. I've kept the answer as Yes. - Michael Chamberland

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Issue ID # 7418

Date Created: October 18, 2021 - 10:09pm
Date Updated: March 7, 2022 - 8:20pm

Submitted by: Lynn Sweet

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q19. Are the plant's propagules frequently dispersed long distance (>100 m) by wind or water?

Issue Description

You are correct- I just wanted to note for other reviewers. I checked this and even though an indication of wind-aided dispersal would usually be a yes, this seems most similar to a samara (e.g. like a maple or ash) and since the references state that it lacks pappus, I'm agreeing that it's a "No." Guidance: "long distance wind dispersal include **hairy pappus (adapted to long distance wind movement), or tufts of hair on small seed**. Samara seeds do not disperse long enough distances to justify a yes to this question." -- Lynn Sweet

Issue Resolution (Screener's Response to Issue)

Yes, I would agree. While the Dimnophotheca seed are flattened and discus-shaped, I do not see a close similarity to a samara. The samara fruit has evolved independently in Acer, Fraxinus, Nissolia, Tipuana, Dipterocarpus, and other genera. Across these many groups there has been a convergence on a shape with a conspicuous wing attached laterally to the seed, tending to afford an airfoil spin on descent. This works best when the seed is dropped from high up, not from a low annual. - Michael Chamberland

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Issue ID # 7417

Date Created: October 18, 2021 - 10:02pm
Date Updated: March 7, 2022 - 6:51pm

Submitted by: Lynn Sweet

Status: Fixed
Type: Suggestion
Severity: Major
Scope: Q17. Does this plant continuously produce seed for >3 months each year or does seed production occur more than once a year?

Issue Description

I understand what you are saying about range-wide flowering time, however, normally with this information we would make this a "yes", that is, flowering period listed as 5 months. Just as a procedural/consistency issue, it might need to be a yes with low confidence. Is there any other information to support flowering greater or less than 3months? --Lynn

Issue Resolution (Screener's Response to Issue)

I have flipped the answer to yes with low confidence, and re-framed the statement as entailing doubt over the interpretation of the flowering range cited in Jepson. - Michael Chamberland

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Issue ID # 7416

Date Created: October 18, 2021 - 9:51pm
Date Updated: March 7, 2022 - 8:04pm

Submitted by: Lynn Sweet

Status: Fixed
Type: Comment
Severity: Minor
Scope: Q08. Is the plant noted as promoting fire and/or changing fire regimes?

Issue Description

Yes agree with Nikkii, I often include a reference for the life history information. Probably the Dave's Garden reference would suffice. FYI I changed the author type for that to a "Corporate" author (see the drop-down when you enter authors) so that the name doesn't change to "Garden, Dave". One of the many tricks for entering references :) -- Lynn Sweet

Issue Resolution (Screener's Response to Issue)

I've added the Dave's Garden reference. - Michael Chamberland

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Issue ID # 7415

Date Created: October 18, 2021 - 5:08pm
Date Updated: March 7, 2022 - 8:05pm

Submitted by: Nicole Valentine

Status: Fixed
Type: Suggestion
Severity: Minor
Scope: Q08. Is the plant noted as promoting fire and/or changing fire regimes?

Issue Description

I think you could put medium confidence instead of low because this is an inference if you include a reference like you did for question 10. Nikki Valentine

Issue Resolution (Screener's Response to Issue)

I've added the Dave's Garden reference and changed the confidence to Medium. - Michael Chamberland

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About PRE and this Plant Evaluation Report

The Plant Risk Evaluator (PRE) is an online database and platform designed to assess the risk of a plant becoming invasive in a given region.This tool offers many benefits, and we encourage you to visit the PRE website (https://pretool.org) for more information.

If you would like to learn more about PRE, please email us at info@plantright.org, requesting a PRE Account.

PRE beta funding was provided by Sustainable Conservation (https://www.suscon.org/) and a USDA Farm Bill grant. Additional funding has been provided by the Western Integrated Pest Management Center.