# Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

## Assessment information

**Common name: Pale swallow-wort, European swallow-wort**

**Scientific name:** *Cynanchum rossicum* (Kleopow) Borhidi synonym *Vincetoxicum rossicum*

**Family name: Asclepidaceae**

Current reviewer name and organizational affiliation: Julie Weisenhorn, University of Minnesota Extension/Horticulture
Date of current review: 08-15-2022
Previous reviewer name and organizational affiliation: Laura Van Riper, Minnesota Department of Natural Resources
Date of previous review: 09-13-2012

## Species description


Photo caption: Pale swallow-wort, Ottawa, Ontario, Canada. Photo: David Nisbet, Invasive Species Centre, Bugwood.org


Photo caption: Pale swallow-wort flowers, Cootes Paradise, Royal Botanical Gardens, Dundas, Ontario, Canada. Photo credit: Rob Routledge, Sault College, Bugwood.org


Photo caption: Pale swallow-wort seed pods and seeds. Photo credit: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

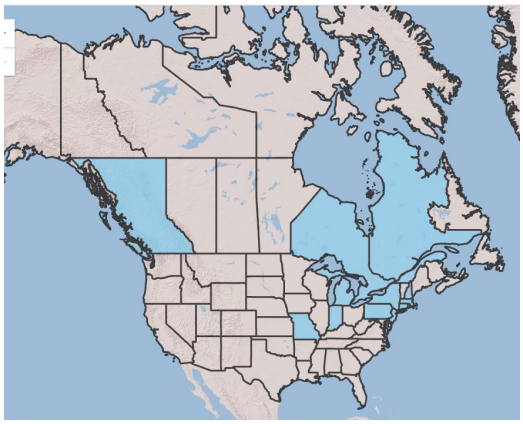
## Why the plant is being assessed

- *Vincetoxicum rossicum*, pale swallow-wort (PSW), is highly invasive and spreads by seed. It grows as dense mats that crowd out native plants and disrupt ecosystems. (Michigan Department of Natural Resources 2012)
- Roots contain haemolytic glycosides which are toxic to mammals including livestock. (Michigan Department of Natural Resources 2012)
- Toxic to many insect larvae. If female monarchs lay their eggs on pale swallow wort, the hatchlings will die. Plant contains compounds with antibacterial and selective anti-fungal properties that inhibit the growth of many pathogens. (Michigan Department of Natural Resources 2012)

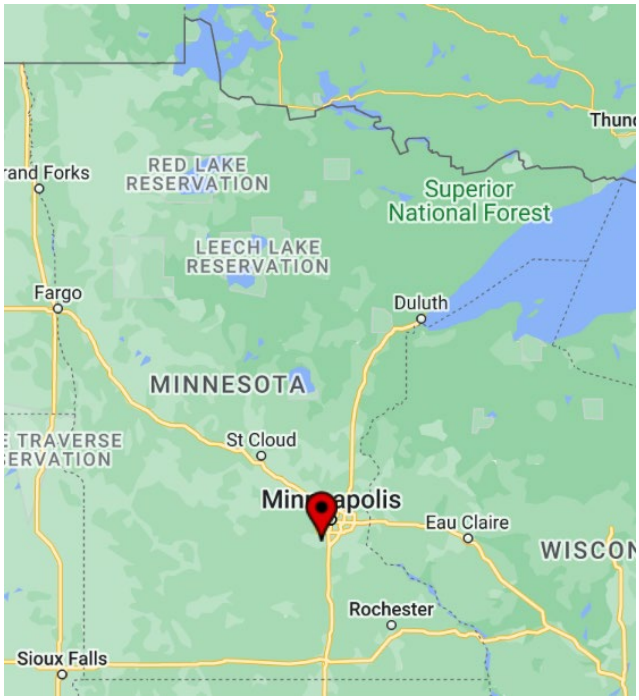
## Identification, biology, and life cycle

- PSW is native to Europe and was introduced to the United States as an ornamental plant. It is widespread in the northeastern United States but is an early detection species in Minnesota as it has limited distribution in the state.
- PSW is a member of the Milkweed family (*Asclepidaceae*). It is an herbaceous perennial twining vine, 3-6.5 ft long (1-2 m), with clear, watery sap. It has shiny, dark green, opposite leaves that are oval or heart-shaped with smooth margins and measure 2-5 in. (5-13cm) long and 1-2.5 in (2-6.5 cm) wide. PSW stems have downy hairs. (Michigan Department of Natural Resources 2012)
- PSW has pink to deep burgundy flowers that bloom in early summer and have petals longer than they are wide and held in clusters attached at the leaf bases. Milkweed-like pods form and split when seeds are ripe. Flat, brown seeds are attached to fluffy white hairs and dispersed via wind in fall. Spreads by seed. A high-density stand in full sun can produce up to 32,000 seeds per square meter. (Michigan Department of Natural Resources 2012)
- PSW is generally found in disturbed areas like old fields, woodlands, and brushy areas. It can invade perennial crops including pastures, tree farms, and no-till fields. It is tolerant of shade, sun, and a variety of soil moistures (Midwest Invasive Species Network 2022) including flooding for a short period of time (Michigan Department of Natural Resources 2012)
- It thrives in shallow soils and limestone bedrock of alvar areas (a biological environment based on a limestone plain with thin or no soil and, as a result, sparse grassland vegetation. Often flooded in the spring, and affected by drought in midsummer, alvars support a distinctive group of prairie-like plants.)
- PSW invades upland areas and tolerates a wide range of light and moisture conditions. It can grow rapidly over native vegetation to the point of dominating the understory of a woodland. Wind-dispersed seeds allow it to disperse over long distances. When it is cut, this plant resprouts vigorously, making control difficult. (EDDMaps 2022)

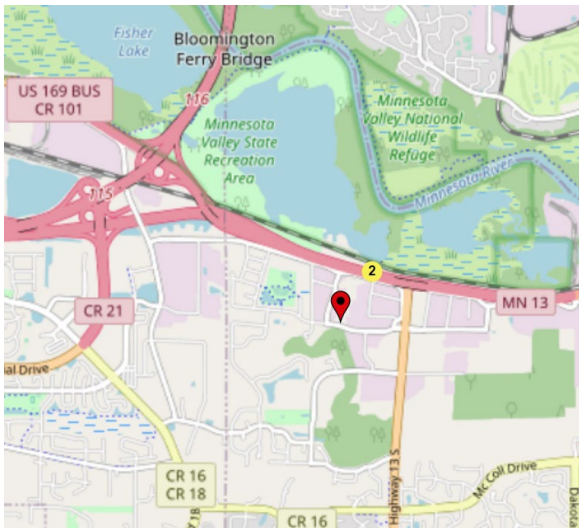
## Current distribution



Map on left: PSW distribution on a continental level map from EDDMapS. Accessed April 25, 2022.
Map on right: PSW distribution on a continental level from USDA Plants. Accessed April 25, 2022.
According to EDDMaps, PWS has been reported in Colorado, Minnesota, Illinois, Ontario, Michigan, Pennsylvania, New York, Maine, New Hampshire, Massachusetts, Connecticut, and New Jersey. USDA Plants reporting is similar; however, it also includes Indiana, Missouri, British Columbia and Quebec, but excludes Minnesota likely because of the 2014 date on the map. PSW was found and confirmed in Minnesota in 2020.




Map caption: State level map of Minnesota from EDDMaps (2022). Three infestions have been found in Scott County - one verified and two not verified. Accessed April 25, 2022.




Map caption: Close up of PSW infestations in Scott County, Minnesota, 2020-2021, from EDDMaps. Red and yellow markers shows where pale swallow wort has been discovered, treated and verified.

Two infestations of PWS were reported on EDDMaps in Savage, Minnesota in Scott County, June 10, 2021 by Loni Anderson, MN DOT: (1) five clusters of plants on 25 acres (density <5%, coordinates 44.77998, -93.38184) and (2) an area of 0.076833 acres with a density of 25-50% (coordinates 44.78005, -93.38249). Anderson sprayed the Individual plants with Garlon® 3A and removed as many flowers and seed pods as possible. A third infestation was found August 5, 2020, in forested understory in Eagle Creek Aquatic Management Area, Scott County, MN (coordinates 44.77599, -93.38584). This moderately covered, two-acre area of mature pale swallow wort was reported by Taralee Latozke, Minnesota Department of Natural Resources (MN DNR), and positively identified by Laura Van Riper, MN DNR, and reviewed by Lindy Ekola, MN DNR. [Garlon® is a registered trademark of Corteva Agriscience and its affiliated companies.]

**From Taralee Latozke, Minnesota DNR Fisheries, lead manager on DNR Managed Land: Eagle Creek Aquatic Management Area, EDDMapS Report 8548694.**

- Pale swallowwort was sprayed multiple times in 2021. It was a drought year and herbicide uptake was bad (this was true for multiple species across multiple sights – not pale swallowwort specific). I sprayed with Garlon® 3A and Garlon® 4 as directed by Monika Chandler and collected seed pods from plants that survived to that stage. Treatments do seem to be setting back the plants. The plan for 2022 is to spray in June and follow up spray in September, and to collect seed pods from plants that survived to that stage.
- Distribution: Pale swallowwort was found on the other side of the creek from the initial find and those plants were treated as well. We walked down Eagle Creek to the Minnesota River with US FWS staff and didn't see any plants further than had been reported previously. Some plants on are DOT lands. Not sure of DOT plans. Some plants had been on city-owned property. That property has now been sold to a private individual. There is a connecting prairie area and then an industrial area. Plants are persisting through the winter. There is concern about spread through the flood plain. They have been looking for plants along the flood plain. They are seeing more spread from existing clumps versus lots of new of seedlings. (Personal communication with Laura Van Riper, Minnesota DNR, April 28, 2022)

**From Christina Basch, Roadside Vegetation Management Specialist, Office of Environmental Stewardship, Minnesota Department of Transportation:** In mid-June 2021, Loni Anderson, Minnesota DOT metro maintenance staff, reported finding some [PSW] plants growing, flowering and seed pods at the original site. Loni and a colleague collected the pods and applied Garlon® 3A at 2%. They continued searching the area West

of that location and adjacent where Eagle Creek flows North under the highway. The search continued back on the North side of 13 and East of Eagle Creek. They traversed the steep hill down to the creek bank in the ROW and found more plants that they had treated the same as mentioned above. They communicated with the Chaska Truck Station to mow the area after 14+ days reminding them to clean the mower on-site. Loni revisited the site a few times and Chaska did a great job mowing the area that they could. She checked down the hill where they could not mow and didn't find any new growth. (Personal email communication to Van Riper et. al, April 28, 2022.)

### Current regulation

PSW is not currently regulated by the Minnesota Department of Agriculture. It has no special federal legal status. It is regulated in the following individual states: Connecticut (prohibited plants list), Indiana (prohibited invasive terrestrial plant), Massachusetts (Prohibited plant), New Hampshire (terrestrial weed), New York (Prohibited), Vermont (Class A noxious weed), and Wisconsin (Prohibited).

## Risk assessment

### Box 1:

**Is the plant species or genotype non-native?**

Answer: Yes.
Outcome: Go to Box 3
Native to eastern regions of the Ukraine and southwestern portions of Russia north of the Black Sea and Caucasus (Di Tommasso et al. 2005). First found in the US in 1891 in New York state (Douglass et al. 2009). Douglass et al. (2009) states: "The most likely source of introduction of both species was importation as specimens for botanical or estate gardens, though this remains uncertain (DiTommaso et al. 2005, Sheeley 1992). For many years the two swallow-wort species were cultivated and sold as ornamental plants, though this is no longer common (DiTommaso et al. 2005, Monachino 1957)."

### Box 2:

**Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production?**

Outcome: Decision tree does not direct to this question.

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### Box 3:

**Is the plant species, or a related species, documented as being a problem elsewhere?**

Answer: Yes.
Outcome: Go to Box 6
It is regulated in the following individual states: Connecticut (prohibited plants list), Indiana (prohibited invasive terrestrial plant), Massachusetts (Prohibited plant), New Hampshire (terrestrial weed), New York (Prohibited), Vermont (Class A noxious weed), and Wisconsin (Prohibited).

Douglass et al. (2009) state: "PSW invasion in North America is centralized in upstate New York, specifically Central New York, the Finger Lakes Region, and the region surrounding Lake Ontario in both the USA and southern Canada. There are additional extensive populations throughout Long Island, NY and other states in the

Northeast, and there have been isolated reports of plant sightings in Indiana, Michigan, Missouri, and Wisconsin (DiTommaso et al. 2005, Weston et al. 2005)."

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**Box 4:**

**Are the plant species' life history and growth requirements understood?**

Outcome: Decision tree does not direct to this question

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**Box 5:**

**Gather and evaluate further information**

Outcome: Decision tree does not direct to this question.

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**Box 6:**

**Does the plant species have the capacity to establish and survive in Minnesota?**

*Question 6A: Is the plant, or a close relative, currently established in Minnesota?*

Answer: Yes.

Outcome: Go to Box 7

Three infestations were discovered in Scott County, Minnesota, in 2020 and 2021. All were confirmed to be as PSW. The plants have survived multiple seasons.

*Question 6B: Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?*

Answer: Yes, although projections are not clear. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

According to USDA Plants (accessed 16 June 2022), PSW is found in Canada (British Columbia, Ontario, Quebec), the Midwest (Michigan, Indiana, Missouri, Pennsylvania) and the Northeastern US (New York, New Jersey, Connecticut, Massachusetts, and New Hampshire. Douglass et al. (2009) state: "Both swallow-wort species are typically found in habitats with temperature ranges in the winter of −11 to 0.7°C (12 – 33 deg F) and in the summer of 20.7–26.4°C (68 – 79 deg F), while mean annual precipitation levels in these areas range from 776–1,206 mm (DiTommaso et al. 2005)." An unpublished study of projected range expansion conservatively estimates that pale swallowwort range could include portions of southeastern Minnesota (Little et al. 2009).

*Question 6C: Has the plant become established in areas having a climate and growing conditions similar to those projected to be present in Minnesota under future climate projections?*

Outcome: Decision tree does not direct to this question.

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**Box 7:**

**Does the plant have the potential to reproduce and spread in Minnesota?**

*Question 7A: Are there cultivars of the plant that are known to differ in reproductive properties from the species?*

Outcome: Go to Question 7B

Answer: No

There are no known cultivars of PSW.

*Question 7B: Does the plant reproduce by asexual/vegetative means?*

Answer: Yes.
Outcome: Go to Question 7C
Douglass et al. (2009) state: "PSW has a stout and often large root crown that produces perennating buds and extensive, fleshly, fibrous roots (DiTommaso et al. 2005). Many plants also possess a horizontal, woody rhizome, though this structure does not appear to substantially facilitate dispersion of the plants (Cappuccino 2004; Weston et al. 2005)."

*Question 7C: Are the asexual propagules - vegetative parts having the capacity to develop into new plants - effectively dispersed to new areas?*

Answer: No.
Outcome: Go to Question 7D
Asexual reproduction seems to be a way that the species increases at a site, but not a primary method of dispersing to new sites.

*Question 7D: Does the plant produce large amounts of viable, cold hardy seeds? For woody species, document the average age the species produces viable seed.*

Answer: Yes.
Outcome: Go to Question 7G
Douglass et al. (2009) state: "At a heavily infested site in northern New York State, Smith (2006) reported a potential seedling output of 62,439 seedlings/m2 when polyembryonic offspring were taken into account." Seeds generally require a cold treatment to germinate (Douglass et al. 2009).

*Question 7E: For species that produce low numbers of viable seeds, do they have a high level of seed/seedling vigor or remain viable for an extended period (seed bank)?*

Outcome: Decision tree does not direct to this question.

*Question 7F: Is the plant self-fertile?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
PSW is self-compatible and is also pollinated by fly, ant, bee, wasp, and beetle species (Douglass et al. 2009).

*Question 7G: Are sexual propagules – viable seeds – effectively dispersed to new areas? List and consider all vectors.*

Answer: Yes.
Outcome: Go to Question 7I
Douglass et al. (2009) state: "Maximum dispersal of seeds found to be up to 60 m from the parent plant (Ladd and Cappuccino 2005). First-year PSW seedlings also have unusually high survivorship (71–100%) when compared with many other herbaceous plant species." Like other members of the milkweed family, seeds are wind dispersed (Czarpata 2005).

*Question 7H: Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?*

Answer: Possible. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
PSW has the potential to hybridize with other European species (DiTommaso et al 2005).

*Question 7I: Do natural controls, species native to Minnesota, which have been documented to effectively prevent the spread of the species in question?*
Answer: No.
Outcome: Go to Box 8
There are no native controls that have been documented.

*Question 7J: Was the answer to Question 7A (Are there cultivars that differ in reproductive properties from the original species) "Yes"?*
Outcome: Decision tree does not direct to this question.

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## Box 8:

## Does the plant pose significant human or livestock concerns or have the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?

*Question 8A: Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?*
Answer: Yes.
Outcome: Go to Box 9
Douglass et al. (2009) state: "There have been numerous reports of landowners abandoning horse pastures due to unmanageable infestations of PSW, possibly due to the physical obstruction posed by dense swallow-wort stands or the suspected toxicity to mammals of plant tissues (Lawlor 2003; Weston et al. 2005). A feeding trial with fresh PSW plant material resulted in the death of a goat from suspected cardiac arrest 4 days after the last tissue treatment, which seems to support evidence from Scandinavia that sheep avoid grazing on PSW plants (DiTommaso et al 2005; Haeggstrom 1990)."

Douglass et al. (2009) state: "The potential for both swallow-wort species to serve as fatal hosts for Monarch butterflies (*Danaus plexippus* L.), a condition in which adults lay eggs on the plants but the larvae do not survive, has been well reported (Casagrande and Dacey 2001; DiTommaso and Losey 2003). Casagrande and Dacey (2007) found that in fields with little or no common milkweed (*Asclepias syriaca* L. – the butterflies' normal host species), the density of eggs found on BSW stems was five times greater than that found in a more diverse old-field site with abundant common milkweed. Although there have been studies that questioned whether swallow worts play a significant role as fatal hosts for Monarch butterflies (Mattila and Otis 2003), it is likely that through the competitive displacement of common milkweed populations, the two swallow-wort species could ultimately pose a serious threat to Monarch butterfly populations in infested areas (DiTommaso et al. 2005; Tewksbury et al. 2002)."

*Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?*
Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Douglass et al. (2009) state: "The detection of PSW plants in no-till corn and soybean fields is problematic given the relative difficulty of controlling either of the swallow-wort species effectively with commonly used herbicides in crop systems (DiTommaso et al. 2005; Lawlor 2003; Weston et al. 2005)."

Douglass et al. (2009) state: "The New York State Forest Owner's Association and many foresters have claimed that swallow-wort infestations in understories are also compromising forest regeneration (Lawlor 2003). Horticultural nursery owners and Christmas tree producers affected by swallow-wort infestations reported that due to lack of effective control methods and regeneration impacts, land abandonment was often the only reasonable option. Indeed, several orchard owners east of Rochester, NY cited PSW as their most problematic weed species (A. Fowler, personal communication; Lawlor 2003)."

*Question 8C: Can the plant aggressively displace native species through competition (including allelopathic effects)?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

PSW has invaded sensitive and rare alvar communities both in eastern Ontario, Canada, and in Jefferson County, NY, and has displaced endemic flora and fauna (DiTommaso et al. 2005). A survey in the affected areas revealed a significant negative correlation between PSW cover and the number and diversity of previously common grassland bird species (DiTommaso et al. 2005). Ernst and Cappuccino (2005) found fewer arthropods both dwelling on PSW plants and ground-dwelling insects adjacent to sampled plants. The authors concluded that the decline in old-field arthropod populations because of the invasion of swallowworts could negatively impact bird and small mammals that also depend on insects for food.

*Question 8D: Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?*

Answer: Potentially. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

The potential may exist for PSW to hybridize with other European species (DiTommaso et al. 2005).

*Question 8E: Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Soils at sites invaded by PSW have been found to have greater AMF inoculums potentials than adjacent, uninvaded sites (DiTommaso et al. 2005, Greipsson and DiTommaso 2006, Smith 2006, Smith et al. 2008). Swallow-wort plants also showed significantly greater growth in the presence of locally associated microbial communities than nonlocal communities. The authors proposed that by altering the species of mycorrhizal fungi at sites, swallow-wort could facilitate its establishment and expansion by displacing resident flora dependent on native fungal species. Once established, both swallow-wort species grow profusely and aggressively. PSW and BSW can rapidly alter the abiotic and biotic features of their understory and surrounding areas: decreasing sunlight penetration, increasing nutrient acquisition through large root biomasses, and altering rhizosphere dynamics both through shifts in the AMF community and the exudation of allelopathic chemicals (Douglass 2008, Greipsson and DiTommaso 2006, Lawlor 2002, Sheeley and Raynal 1996, Weston et al. 2005).

*Question 8F: Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?*

Outcome: Decision tree does not direct to this question.

**Box 9:**

**Does the plant have clearly defined benefits that outweigh associated negative impacts?**

*Question 9A: Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?*

Answer: No.
Outcome: Go to Question 10
PSW is native to Eastern Europe. According to Jim Calkins of the Minnesota Nursery and Landscape Association, Nursery and Landscape Association, PSW is not sold or propagated by the Minnesota nursery and greenhouse industry. (Personal email with Julie Weisenhorn, 2022). The closely related black swallow-wort (*Cyanchum louiseae*) has been a Prohibited – Eradicate Noxious Weed since 2013 and illegal to sell or propagate. (Minnesota Department of Agriculture 2022).

*Question 9B: Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized, through carefully designed and executed management practices?*

Outcome: Decision tree does not direct to this question.

*Question 9C: Is the plant native to Minnesota?*

Outcome: Decision tree does not direct to this question.

*Question 9D: Is a non-invasive, alternative plant material or cultivar commercially available that could serve the same purpose as the plant of concern?*

Outcome: Decision tree does not direct to this question.

*Question 9E: Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?*

Outcome: Decision tree does not direct to this question.

**Box 10:**

**Should the plant be regulated as Prohibited/Eradicate, Prohibited/Control, or Restricted Noxious Weed?**

*Question 10A: Is the plant currently established in Minnesota?*

Answer: Yes.
Outcome: Go to Question 10D
Three infestations have been found in Scott County, Minnesota (EDDMaps 2022).

*Question 10B: Would prohibiting this species in trade prevent the likelihood of introduction and/or establishment?*

Outcome: Decision tree does not direct to this question.

Question 10C: Does this risk assessment support this species being a top priority for statewide eradication if found in the state?

Outcome: Decision tree does not direct to this question.

*Question 10D: Does the plant pose a serious human health threat?*
Answer: No
Outcome: Go to Question 10F
PSW poses no threat to human health.

*Question 10E: Is the health threat posed by the plant serious enough, and is the plant distribution sufficiently small enough to be manageable, and are management tools available and effective enough to justify listing as Prohibited / Eradicate species?*
Outcome: Decision tree does not direct to this question.

*Question 10F: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>eradicated</u> (entire plant) on a statewide basis using existing practices and available resources considering the distribution, reproductive biology and potential for spread?*

- *For distribution, note if the distribution is well documented, the number and acreage of known infestations and how widespread they are in the state. Note if there are infestations in border areas.*
- *For reproductive biology, note if there are reproductive biology factor that make the plant easier to control and eradication more likely (for example, long pre-reproductive period, self-incompatible pollination, short-lived seed bank).*
- *For potential for spread and re-invasion of controlled areas, note its potential to spread beyond places where it is being controlled such as deliberate planting by people, wildlife vectors, re-infestation from border states, or other factors that facilitate spread.*
- *For known management tools, note what management tools are available, potential non-target impacts, and the reasonableness of state management or mandating that landowners throughout the state use the management tools to eradicate or control existing plants.*
- *For available resources, consider the capacity of state and local personnel and availability of funding to respond to new and existing infestations.*

Answer: Yes
Outcome: Go to Question 10G
**Ecological Impact:**
PSW has invaded sensitive and rare alvar communities both in eastern Ontario, Canada, and in Jefferson County, NY, and has displaced endemic flora and fauna (DiTommaso et al. 2005). A survey in the affected areas revealed a significant negative correlation between PSW cover and the number and diversity of previously common grassland bird species (DiTommaso et al. 2005). Ernst and Cappuccino (2005) found fewer arthropods both dwelling on PSW plants and ground-dwelling insects adjacent to sampled plants. The authors concluded that the decline in old-field arthropod populations because of the invasion of swallowworts could negatively impact bird and small mammals that also depend on insects for food.

Additional ecological impacts include negative impacts to monarch butterflies. Douglass et al. (2009) state: “The potential for both swallow-wort species to serve as fatal hosts for Monarch butterflies (*Danaus plexippus* L.), a

condition in which adults lay eggs on the plants but the larvae do not survive, has been well reported (Casagrande and Dacey 2001; DiTommaso and Losey 2003). Casagrande and Dacey (2007) found that in fields with little or no common milkweed (*Asclepias syriaca* L. – the butterflies' normal host species), the density of eggs found on BSW stems was five times greater than that found in a more diverse old-field site with abundant common milkweed. Although there have been studies that questioned whether swallow-worts play a significant role as fatal hosts for Monarch butterflies (Mattila and Otis 2003), it is likely that through the competitive displacement of common milkweed populations, the two swallow-wort species could ultimately pose a serious threat to Monarch butterfly populations in infested areas (DiTommaso et al. 2005; Tewksbury et al. 2002)."

**Economic impact:** Douglass et al. (2009) state the following economic impacts:

- "The detection of PSW plants in no-till corn and soybean fields is problematic given the relative difficulty of controlling either of the swallow-wort species effectively with commonly used herbicides in crop systems (DiTommaso et al. 2005; Lawlor 2003; Weston et al. 2005)."
- "The New York State Forest Owner's Association and many foresters have claimed that swallow-wort infestations in understories are also compromising forest regeneration (Lawlor 2003). Horticultural nursery owners and Christmas tree producers affected by swallow-wort infestations reported that due to lack of effective control methods and regeneration impacts, land abandonment was often the only reasonable option. Indeed, several orchard owners east of Rochester, NY cited PSW as their most problematic weed species (A. Fowler, personal communication; Lawlor 2003)."
- "There have been numerous reports of landowners abandoning horse pastures due to unmanageable infestations of PSW, possibly due to the physical obstruction posed by dense swallow-wort stands or the suspected toxicity to mammals of plant tissues (Lawlor 2003; Weston et al. 2005). A feeding trial with fresh PSW plant material resulted in the death of a goat from suspected cardiac arrest 4 days after the last tissue treatment, which seems to support evidence from Scandinavia that sheep avoid grazing on PSW plants (DiTommaso et al 2005; Haeggstrom 1990)."

**Distribution and Potential for Reinvasion:** PSW has very limited distribution in Minnesota, making it a good candidate for an eradicate list species. The one known location is isolated and there are limited to no populations in neighboring states, reducing likelihood of reinvasion.

**Reproductive Biology and Management**: Both PSWs and BSWs can rapidly regrow from buds on the root crown, rendering mowing, tillage, clipping, and other frequently used control strategies less effective against these perennials (Averill et al. 2008, Lawlor 2002; Lawlor and Raynal 2002, Weston et al. 2005). The most effective chemical treatments were glyphosate (10.4 kgai ha−1) applied at an early stage of flowering and triclopyr (2.6 kg ai ha−1) applied at early fruit formation, both of which resulted in a 73% reduction in cover, decreased densities, and a loss of apical dominance (Lawlor and Raynal 2002).

People in Minnesota have been successfully managing the closely related black swallow-wort. Pale swallow-wort management methods follow those recommendations. The Minnesota Department of Transportation Noxious Weed Guide cites the goals of controlling seed production and stimulating competitive plant cover through the manual removal and destruction of plants and root crowns. "Repeated mowing or cutting can impact plants but will not eradicate a population. After early season mowing or cutting, plans must be in place to monitor and repeat the process as necessary. Black swallow-wort if cut early in the season can still produce seed that year and the goal of cutting is to eliminate seed production. If seeds are present, clean equipment before moving offsite. Prescribed fire can be used in conjunction with other management efforts to encourage stands of native grasses that will compete with black swallow-wort for resources. Monitoring will be necessary to control resprouting and seedlings that germinate after burns are completed. Herbicide applications should target plants at or beyond flowering stage. As plants reach maturity, foliar applications of glyphosate or triclopyr ester cover

enough surface area to potentially deliver a lethal dose to the root system. Timing the application prior to pod formation may limit the production of viable seed that season. Applying herbicide to early emerging plants with limited foliar area will likely result in roots remaining viable and plants resprouting" (Minnesota Department of Transportation 2022).

Biocontrol: Researchers Tewksbury, Szücs, Parry and Smith presented on their experiments around eradicating PSW and BSW using around eradicating PSW and BSW using *Hypena opulenta*. While some successes such as a few subjects overwintering, researchers noted difficulties in rearing *H. opulenta*, day length and the diapause (period of insect's suspended development), overwintering mortality, female egg dispersal, and availability of base populations of insects. Parry noted people should "temper their enthusiasm" and Szücs indicated digging out swallow worts is the best way to eradicate it. (Eastern Lake Ontario Swallow-wort Collaborative 2021)

*Question 10G: Is the plant known to cause significant ecological or economic harm and can the plant be reliably controlled to limit spread on a statewide basis using existing practices and available resources? Would the economic impacts or other hardships incurred in implementing control measures be reasonable considering any ongoing or potential future increase of ecological or economic harm?*

- *Also consider all bullet points listed under 10F when evaluating 10G*

Outcome: Decision tree does not direct to this question.

*Question 10H: Would prohibiting this species in trade have any significant or measurable impact to limit or reduce the existing populations or future spread of the species in Minnesota?*
Outcome: Decision tree does not direct to this question.

*Question 10I: Are there any other measures that could be put in place as Special Regulations which could mitigate the impact of the species within Minnesota?*
Outcome: Decision tree does not direct to this question.

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**Box 11:**

**The species is being proposed to be designated as a Specially Regulated Plant. What are the specific regulations proposed?**
Outcome: Decision tree does not direct to this question.

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# Final results of risk assessment (2022)

## NWAC Listing Subcommittee

Outcome: List as a Prohibited Eradicate Noxious Weed. (06/17/2022)
Comments: There was consensus on this recommendation.

## NWAC Full Committee

Outcome: List as a Prohibited Eradicate Noxious Weed. (12/13/2022)
Comments: The vote was 16 in favor and 2 against.

### MDA Commissioner

Outcome: List as a Prohibited Eradicate Noxious Weed.
Comments: No comments

## Risk Assessment Current Summary (08-15-2022)

In the 2012 assessment, a 2009 paper by Little et. al indicated PSW would not survive in Minnesota. Ten years later, three populations have been found the Minnesota in the Twin Cities area and proved this to be incorrect. We know that:

- PSW is harmful to livestock and monarch butterflies, damaging to native ecosystems, and economically harmful to farmers and foresters.
- PSW can survive in Minnesota.
- PSW is listed in other states as a noxious weed.
- PSW can be mechanically removed and treated with current pesticides and eradicated. Biocontrol is still in its early days.
- There are no commercially produced cultivars in the market.

Due to the negative impacts of pale swallow-wort and its limited distribution in Minnesota, pale swallow-wort should be listed as a PROHIBITED / ERADICATE NOXIOUS WEED.

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**Personal communication**

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