

Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

Assessment information

Common name: Siberian elm

Scientific name: *Ulmus pumila* L.

Family name: Ulmaceae

Current reviewer name and organizational affiliation: David Hanson, Minnesota Department of Transportation

Date of current review: November 13, 2020

Species description

Siberian elm (*Ulmus pumila* L.) is often referred to as Chinese elm, however that common name is correctly applied to *U. parvifolia*. The Flora of North America and Wisconsin Department of Natural Resources list synonyms:

- *Ulmus campestris* var. *pumila* Maximowicz
- *Ulmus manshurica* Nakai
- *Ulmus turkestanica* Requier

Photos



Siberian elm image 1: Form image illustrates heavy spring seed set. Photo credit: Dave Hanson, Minnesota Department of Transportation.

Siberian elm image 2: Siberian elm leaves on a 1 inch grid. Photo credit: Dave Hanson, Minnesota Department of Transportation.

Why the plant is being assessed

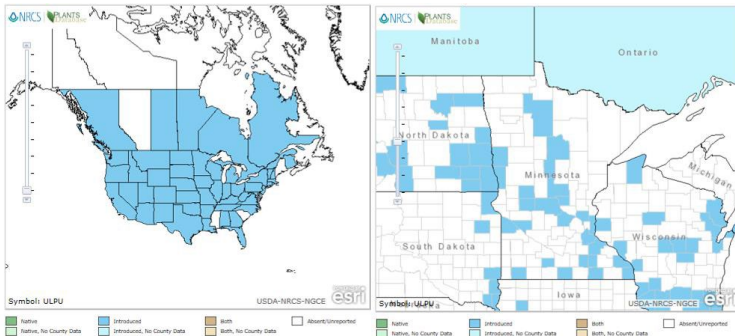
- Concern over the potential to alter ecosystems.
- Introduced into North America in the 1860s its popularity grew from 1905 into the 1930's. After its introduction, until the 1950's when Siberian elm fell out of favor, it naturalized in many North American locations (Elowsky et. al. 2013).
- Siberian elm does invade prairie restorations and natural prairie remnants. With proper fire management and occasional mowing Siberian elm can be kept under control (Kennay and Fell 2009).
- Cowling Arboretum documents note that "Especially proficient at invading disturbed prairies, being able to dominate new locations, especially recently planted prairie restorations, in just a few years." Yet, in a comparison to common buckthorn states "Siberian elm is rarely in as concentrated of patches, requiring less disturbance for full eradication." (Cowling Arboretum, 2020).
- Siberian elm is often labeled an invasive species, but Welby Smith (2008) states in his book "Siberian elm is considered a nuisance rather than an ecological threat."

Identification, biology, and life cycle

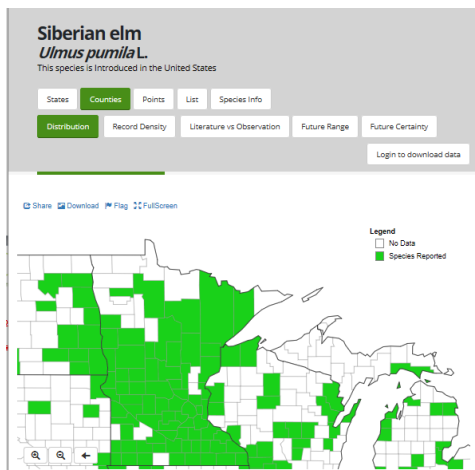
- Considered a medium to large tree attaining heights of 35 to 80 feet.
- Trunks 1 to 3 feet diameter at breast height. Gray bark has flat-topped ridges while furrows are deep and irregular.
- Twigs (year 1) are slightly fuzzy to fuzzy.
- Alternate, simple lanceolate foliage approximately $\frac{3}{4}$ to 3 inches long by $\frac{1}{2}$ to $1\frac{1}{2}$ inches wide. Margins are serrate, maybe double serrate. Leaf bases are tapered or blunt and nearly equal while apex is acute to acuminate. Glabrous, smooth, dark green upper surface. Lower surface with hairs in the vein axils, pale in color.
- Flowers are borne in leaf axils on previous years stems. Sessile clusters of 5 to 15 flowers. Flowers are not showy.
- Fruit is a one-seeded, nearly $\frac{1}{2}$ inch across, circular, hairless samara. Notch at apex of samara is closed.
- Wind pollinated flowers appear late April to early May, before leaves emerge.
- Samaras are dispersed by wind mid-May into June.
- Germination is within 1 to 2 weeks if conditions are right, warm temperatures and moist, bare soils.
- Appearance similar to Minnesota native elms; American (*U. americana*), red (*U. rubra*), and rock (*U. thomasi*).

According to the [USDA \(NRCS\) plant fact sheet](#) (Moore 2003), this species prefers well-drained, fertile soil and full sun, however, it is highly adaptable and easily tolerates, even thrives in, a variety of conditions such as poor, dry soils, cold winters and long periods of summer drought. Siberian elm has invaded mesic, dry, and sand prairies.

Current distribution



USDA Plants database Siberian elm map (accessed 15 July 2020) indicates presence in all but 3 of the Lower 48 United States (Maine, Mississippi and South Carolina are excluded) and present in 5 of the 10 Canadian Provinces (Quebec, Ontario, Manitoba, Saskatchewan and British Columbia). The Minnesota County level map presented above does not paint an accurate picture of Siberian elm distribution in Minnesota. The EDDMapS and MNTaxa maps below are more accurate, showing Siberian elm in most Minnesota counties.



Left: State level map from EDDMapS. Accessed 15 July 2020.

Right: State level map from Minnesota Department of Natural Resources MN TAXA. MNTAXA information is gathered from several resources - Minnesota Biological Survey data as well as herbarium records.

Current regulation

New Mexico: Siberian Elm, Class C noxious weed.

Wisconsin: NR 40 - Restricted (hybrids and individuals used as rootstock are exempt) (USDA Plants Database, Wisconsin NR 40).

Risk assessment

Box 1:

Is the plant species or genotype non-native?

Answer: Yes

Outcome: Go to Box 3.

Native range is China, Korea and Siberia (Morton Arboretum 2020). Native to central Asia, eastern Siberia, Mongolia, northern China, India and Korea (Wisconsin NR 40).

Box 2:

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

Question 2A: Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?

Outcome: Decision tree does not direct to this question.

Question 2B: Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?

Outcome: Decision tree does not direct to this question.

Box 3:

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

Answer: Yes

Outcome: Go to Box 6

As stated above, Siberian elm is a regulated species in the Wisconsin and New Mexico (USDA Plants Database, Wisconsin NR 40). From Wisconsin's NR 40 overview, Siberian elms ecological threat is stated as follows:

- Tolerates a wide variety of growing conditions including extreme temperatures, nutrient-poor soils and low moisture.
- Can be found along roadsides, in pastures and grasslands, stream banks, and prairies.
- Due to fast development and germination of seeds, dense thickets form rapidly, displacing native vegetation and reducing forage for native fauna.

Following quotation is from the Morton Arboretum (2020) Siberian elm fact sheet: "Siberian elms have invasive traits that enable them to spread aggressively. While these trees have demonstrated invasive traits, there is insufficient supporting research to declare them so pervasive that they cannot be recommended for any planting sites."

After listing many faults of Siberian elm including insect problems, hardiness issues, and invasiveness John Ball (2013) states; "There is little to recommend its continued use in the region."

Welby Smith (2008) suggests Siberian elm is invasive but it seldom alters ecosystems and states: "For the most part Siberian elm is considered a nuisance rather than an ecological threat."

Siberian elm does invade prairie restorations and natural prairie remnants. With proper fire management and occasional mowing Siberian elm can be kept under control (Kennay and Fell 2009).

Cowling Arboretum documents note that “Especially proficient at invading disturbed prairies, being able to dominate new locations, especially recently planted prairie restorations, in just a few years.” Yet, in a comparison to common buckthorn states “Siberian elm is rarely in as concentrated of patches, requiring less disturbance for full eradication.” (Cowling Arboretum, 2020).

Box 4:

Are the plant species’ life history & growth requirements understood?

Outcome: Decision tree does not direct to this question.

Box 5:

Gather and evaluate further information

Outcome: ***This text is provided as additional information and is not directed through the decision tree process.***

Siberian elm is used as a parent plant in a number of cultivars and hybrids.

Siberian Elm cultivars or hybrids including parentage of *U. pumila*.

- *U. pumila* ‘Chinkota’ – South Dakota State University introduction. Cultivar is propagated by seed (Ball 2013).

University of Minnesota elm trials test several Dutch elm disease resistant selections including *U. pumila* parentage (Giblin and Gilman 2006).

- Homestead - a complex hybrid of *U. carpinifolia*, *U. pumila* and *U. hollandica*.
- Commendation™ - a complex hybrid of *U. carpinifolia*, *U. pumila* and Accolade™ heritage.
- Cathedral – *U. pumila* X *japonica*
- New Horizon – *U. pumila* X *japonica*
- Vanguard™ – Complex hybrid with *U. pumila* and *U. japonica* heritage.

Michael Dirr (1975) lists several cultivars introduced to provide Dutch elm disease resistance.

- ‘Chinkota’ - *U. pumila*
- ‘Coolshade’ and ‘Improved Coolshade’ – *U. pumila* X *U. rubra*
- ‘Dropmore’ – Hardy in Dropmore, Manitoba, Canada and is a selection from Harbin China.
- ‘Hamburg Hybrid’ – *U. americana* X *U. pumila*
- ‘Lincoln’ – *U. pumila* X *U. rubra*
- ‘Pendula’ – pendulous branches.

To restate from the Current Regulation section above: Wisconsin NR 40 regulates Siberian elm as Restricted with hybrids and individuals used as rootstock exempt.

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

See maps above under section heading “Current Distribution” from USDA Plants and EDDMapS referenced in January 2020. And, Welby Smith (2008) discusses its presence in Minnesota as well as a county / sub-county map indicating its presence.

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

Outcome: Decision tree does not direct to this question.

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.

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?

Answer: No - not likely.

Outcome: Go to Question 7B

I have found no indication that the Siberian Elm cultivars listed in Box 5 which include parentage of *U. pumila* are less “seedy” than the straight species. The elm cultivar ‘Frontier’ (*Ulmus carpinifolia* x *parvifolia* ‘Frontier’) is said to “rarely flower” (Monrovia 2020).

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

Answer: No. ***This text is provided as additional information and is not directed through the decision tree process.***

See also Question 7G. Quotation from a study conducted in Mongolia on what I would consider extreme sites indicating trees are not producing seed at an early age but can stump sprout. “Mean age of the sample trees was as low as 17 years. At this age, the trees are not fertile, but proliferate vegetatively” (Dulamsuren et. al. 2009). The vegetative reproduction mentioned here is stump sprouting (coppice) which while it maintains that plant it does not lead to proliferation of the species in the area.

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

Outcome: Decision tree does not direct to this question.

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

I have found no reference documenting the age of fertility or early seed production.

Through deductive reasoning, PIER in 2008 came up with the following conclusion to this question: “American Elm reaches reproductive maturity at around 15 years of age ... *Ulmus rubra* - Large crops are borne every 2 to 4 years, beginning after age 15. [Probably > 4 years, given that the closely related conspecifics which are also large trees take about 15 years to reach reproductive stage].”

Quotation from a study conducted in Mongolia on what I would consider extreme sites indicating trees are not producing seed at an early age but can stump sprout. “Mean age of the sample trees was as low as 17 years. At this age, the trees are not fertile, but proliferate vegetatively” (Dulamsuren 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)?

Answer: ***This text is provided as additional information and is not directed through the decision tree process.*** High numbers of viable seeds with a germination rate of almost 100% in a short period of time. *Ulmus pumila* is considered a non-seed-banking species (Cabra-Rivas and Castro 2016).

Question 7F: Is the plant self-fertile?

Answer: ***This text is provided as additional information and is not directed through the decision tree process.*** Plants are self-fertile (Hilty 2002, PIER 2008).

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

Answer: Yes

Outcome: Go to Question 7I

Predominant vector is wind dispersal. Water should also be considered as a potential vector. According to Illinois Wildflowers webpage, seeds are also eaten by several species of song and game birds as well as various squirrel species, chipmunks and other rodents (Hilty 2002). These associations would also aid in seed dispersal.

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: Yes. ***This text is provided as additional information and is not directed through the decision tree process.***

Cultivars have been selected from crosses with Minnesota’s native species *U. rubra*. See Box 5 and Box 8D.

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

Elm leaf beetle causes severe leaf damage late in the season, not detrimental to the species. Siberian elm does demonstrate resistance to Dutch elm disease but after repeated attacks the trees can fail (Dirr 1975). However, neither of these problems limits seed production and subsequent spread across the landscape (personal observation).

Question 7J: Was the answer to Question 7A (Are there cultivars that differ in reproductive properties from the original species) “Yes”?

Answer: No. *This text is provided as additional information and is not directed through the decision tree process.*

The elm cultivar 'Frontier' (*Ulmus carpinifolia* x *parvifolia* 'Frontier') is said to "rarely flower" (Monrovia 2020).

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: No

Outcome: Go to Question 8B

Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?

Answer: No

Outcome: Go to Question 8C

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

Answer: No

Outcome: Go to Question 8D

From Wisconsin's NR 40 overview, Siberian elm's ecological threat is stated as follows:

- Tolerates a wide variety of growing conditions including extreme temperatures, nutrient-poor soils and low moisture.
- Can be found along roadsides, in pastures and grasslands, stream banks, and prairies.
- Due to fast development and germination of seeds, dense thickets form rapidly, displacing native vegetation and reducing forage for native fauna.

Cowling Arboretum documents note that "Especially proficient at invading disturbed prairies, being able to dominate new locations, especially recently planted prairie restorations, in just a few years." (Cowling Arboretum, 2020).

Following quotation is from the Morton Arboretum (2020) Siberian elm fact sheet: "Siberian elms have invasive traits that enable them to spread aggressively. While these trees have demonstrated invasive traits, there is insufficient supporting research to declare them so pervasive that they cannot be recommended for any planting sites."

After listing many faults of Siberian elm including insect problems, hardiness issues, and invasiveness John Ball (2013) states; "There is little to recommend its continued use in the region." Welby Smith (2008) suggests Siberian elm is invasive but it seldom alters ecosystems and states: "For the most part Siberian elm is considered a nuisance rather than an ecological threat." In addition, Michael Dirr (1975) has nothing good to say about the tree, but does not berate it for ecosystem damage:

- "A poor ornamental tree that does not deserve to be planted anywhere!"
- "One of, if not, the world's worst trees."
- "Native to eastern Siberia, northern China, Manchuria, Korea, and unfortunately, was not left there."

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

Answer: Yes, research has shown this to be true with *Ulmus pumila* and native *Ulmus rubra*.

Outcome: Go to Box 9

Three quotes from Slippery elm write-up (Burns and Honkala 1975):

- “Slippery elm is commonly crossed with Siberian elm (*Ulmus pumila*).”
- “There are no genetic barriers to gene exchange among diploid elm species”
- “A triploid elm has been reported that was determined to be an F₁ seedling of Siberian elm x slippery elm.”

Natural hybrid crosses of *Ulmus rubra* with *Ulmus pumila* are proposed to be called *Ulmus x intermedia*. *Ulmus x intermedia* is known in Iowa, Minnesota, Kansas, South Dakota, Texas, Nebraska, Illinois, and probably elsewhere (Elowsky et al. 2013). Zalapa et al. (2009) note “Our study indicates widespread hybridization between *U. pumila* and *U. rubra* and an asymmetric pattern of introgression toward *U. pumila*”.

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 text is provided as additional information and is not directed through the decision tree process.**

Yes, but typically Siberian elm is taking advantage of disturbance or waste places. Not necessarily a strong competitor. Will invade open waste (disturbed) sites, but does not perform well in forest understories. So, typically does not alter forest composition to a great extent.

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 - a more appropriate answer is straight species *Ulmus pumila*, unlikely.

Outcome: Go to Box 10

Siberian Elm cultivars or hybrids including parentage of *U. pumila*.

- *U. pumila* ‘Chinkota’ – South Dakota State University introduction. Cultivar is propagated by seed (Ball 2013).

University of Minnesota elm trials test several Dutch elm disease resistant selections including *Ulmus pumila* parentage (Giblin and Gilman 2006).

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- ‘Pendula’ – pendulous branches.

To restate from the Current Regulation section above: Wisconsin NR 40 regulates Siberian elm as Restricted with hybrids and individuals used as rootstock exempt.

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, plant is currently established in Minnesota.

Outcome: Go to Question 10D

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

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 eradicated (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 factors 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: No

Outcome: go to Question 10G

Siberian elm (*U. pumila*) is naturalized across the state of Minnesota having been used in landscapes and farm windbreaks for years. Therefore, for feasibility reasons (financial and time required), Siberian elm shouldn't go on the Prohibited: Eradicate or Prohibited: Control sections of the list.

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

Answer: No

Outcome: go to Question 10H

Siberian elm (*U. pumila*) is naturalized across the state of Minnesota having been used in landscapes and farm windbreaks for years. Therefore, for feasibility reasons (financial and time required), Siberian elm shouldn't go on the Prohibited: Eradicate or Prohibited: Control sections of the list.

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?

Answer: No

Outcome: go to Question 10I

Siberian elm (*U. pumila*) is naturalized across the state of Minnesota having been used in landscapes and farm windbreaks for years. Discussion amongst NWAC listing subcommittee members came to the conclusion that currently Siberian elm has limited movement in the nursery trade and a wide population distribution within Minnesota. Thus placing Siberian elm on the Restricted Noxious Weed List would be of little value to Minnesota.

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?

Answer: No

Outcome: DO NOT LIST THE PLANT

Do not list Siberian elm at this time. No Special Regulations have been identified that would significantly impact Siberian elm across the state of Minnesota.

Box 11:

The plant is being designated as a Specially Regulated Plant. What are the specific regulations proposed?

Outcome: Decision tree does not direct to this question.

Final outcomes of risk assessment (2020)

NWAC Listing Subcommittee

Outcome: Listing Subcommittee recommendation is DO NOT LIST Siberian elm

Comments: Siberian elm (*U. pumila*) is naturalized across the state of Minnesota having been used in landscapes and farm windbreaks for years. Therefore, for feasibility reasons (financial and time required), Siberian elm shouldn't go on the Prohibited: Eradicate or Prohibited: Control sections of the list. Additionally, at this time, it is the opinion of Listing Subcommittee members that placing Siberian elm on the Restricted Noxious Weed list to restrict sales or limit movement would have little impact on the current distribution of Siberian elm within Minnesota. Also at this time, no Special Regulations have been identified that would significantly impact Siberian elm across the state of Minnesota.

NWAC Full Committee

Outcome: Do not list

Comments: Vote was 15-0 to not list.

MDA Commissioner

Outcome: Do not list

Comments: No comments

Risk Assessment Current Summary (04-26-2021)

- There has been discussion in the subcommittee regarding hybrids and as additional information some of the current hybrids are listed in Box 5 and again in Box 9. Hybrids listed in Box 5 and in Box 9 under question 9A are the result of years of research in an effort to combat Dutch elm disease (*Ophiostoma novo-ulmi*). Siberian elm (*Ulmus pumila*) brings some resistance to Dutch elm disease into the hybrid strains. It would not be wise to list these specific hybrids as noxious weeds; yet, it is unlikely that any of them are less prolific in seed production than the straight species. Wisconsin avoids this conflict with additional language for Siberian elm classifying it as: Restricted (hybrids and individuals used as rootstock are exempt).
- Siberian elm (*U. pumila*) is naturalized across the state of Minnesota having been used in landscapes and farm windbreaks for years. Therefore, for feasibility reasons (financial and time required), Siberian elm shouldn't go on the Prohibited: Eradicate or Prohibited: Control sections of the list.
- Additionally, at this time, it is the opinion of Listing Subcommittee members that placing Siberian elm on the Restricted Noxious Weed list to restrict sales or limit movement would have little impact on the current distribution of Siberian elm within Minnesota. Also at this time, no Special Regulations have been identified that would significantly impact Siberian elm across the state of Minnesota.
- Questions in Box 10 underwent additional changes to address scenarios such as the one presented here with Siberian elm. Changes were required to provide a "Do Not List" option within Box 10.
- Full Committee, September 2020 meeting: Comment was made by Steve Chaplin suggesting that this risk assessment should acknowledge that Siberian elm will invade prairies, but can be controlled with regular management.
- The commissioner agreed with the recommendation to not list (04-26-2021).

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