Najas tenuissima (a plant, no common name)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, September 2020
Revised, December 2020
Web Version, 3/29/2021

Organism Type: Plant
Overall Risk Assessment Category: Uncertain

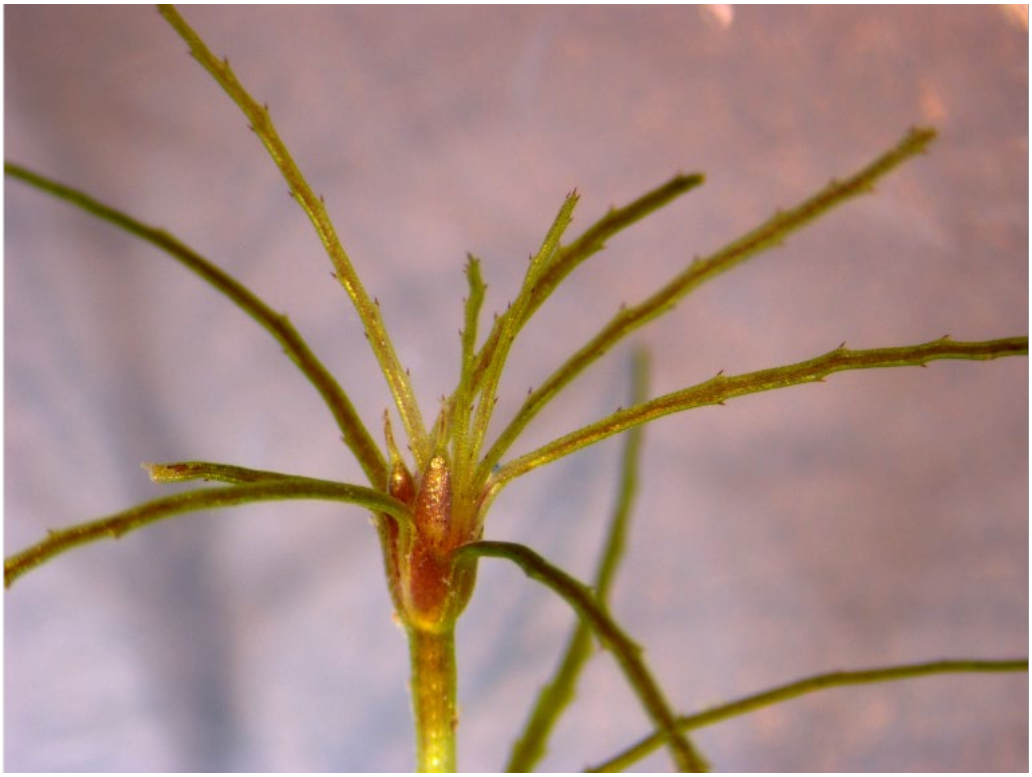

Photo: Marja Koistinen. Licensed under CC BY-NC-4.0. Available: https://laji.fi/en/taxon/MX.40171. (September 2020).

1 Native Range and Status in the United States

Native Range

From Vargot et al. (2016):

"*Najas tenuissima* (Hydrocharitaceae) is an endangered relict species with a disjunctive range in Eastern Europe, in the Urals, in Siberia and Kazakhstan, and in the Far East, in Japan. […] The species is known reliably in Fennoscandia, Latvia, Russian Federation (Leningrad region,

Novgorod region, Tver region, Ryazan region, Republic of Mordovia, Sverdlovsk region, Chelyabinsk region, Irkutsk region, Amur region, Krasnoyarsky Krai and Primorsky Krai), Northern and Eastern Kazakhstan and Japan."

Vargot et al. (2016) provides a table (Appendix 1 of source material) with the following distribution information:
Finland: Lake Ruuanvesi in Southern Savonia, in the river near Borgo city, Lake Vesijärvi, in the gulf near Lehmoniemi in Southern Tavastia, near Vyborg city in the gulf; and other lakes
Latvia: Lake Ardavs, Lake Sivers
Kazakhstan: water reservoir Sergeevskoe, oxbow lake of the Irtysh River
Japan: island Hokkajdo [sic]
The following regions within the Russian Federation:
Novgorod region: Lake Piros, Lake Pestovo in the Demyansky district
Leningrad region: Marshes along north coast of island Kotlin, Lake Glubakoe in the Kotelskiy Reserve, Finnish Gulf in Vyborg district and in the neighborhood of Saint Petersburg (near settlements Lakhta, Lisiy Nos, Razliv)
Tver region: Lake Bologoe, Lake Kolomenskoe, Lake Ostrovno, Lake Borovno
Ryazan region: backwater Prudkovskaya in Lake Velikoe, near the village Barskoe; Lake Beloe near the village Batykovo
Repbulic Mordovia: in the ponds Bolshoy Filippovsky and Maly Filippovsky
Sverdlovsk region: Lake Isetskoe
Chelyabinsk region: northern part of Lake Bolshoe Miassovo
Krasnoyarsky Krai: Mozharskie lakes, Lake Spasskoe, Lake Tiberkul
Irkutsk region: lower reaches of the Ozernaya River, Lake Blizhnee
Amur region: lakes in floodplains of the rivers Amur, Zeya, Bureya, Selemdzha
Primorsky Krai: small waterbody near the coast between the villages Zarubino and Andreevka

From Shiga et al. (2020):

"Distribution. Khar-Us Lake (No. 1) in Mongolia; also found in Finland, Japan, Kazakhstan (North and East), Latvia, and Russia."

Status in the United States

No records of *Najas tenuissima* in trade or in the wild in the United States were found.

Means of Introductions in the United States

No records of *Najas tenuissima* in the wild in the United States were found.

Remarks

Information for this assessment was searched for using the valid name *Najas tenuissima* and the synonyms *N. yezoensis* and *Caulinia tenuissima*.

Lansdown (2011):

"*Najas tenuissima* is classed as Endangered (EN) B2ab(iii)c(iv) in Finland (Rassi et al. 2010) and categorized Critically Endangered (A4c) in Russia (I. Illarionova pers. comm. 2010). It is classed as Endangered in the Red Data Book of the Leningrad Region (Tzvelev 2000). In that region, the species is protected and occurs in a protected area in Prigranichny. In Finland, the five lakes where *N. tenuissima* is growing, are entirely included in the Natura 2000 network. Some of them have been protected as nature conservation areas. Parts of four other lakes holding populations of the species are included in the Natura 2000 network. The species is protected in Finland and assessed as a species under strict protection in national legislation."

"In the EU 27 member states Finland and Latvia, this plant is classed as Endangered B2ab(iii) as it has a restricted range (area of occupancy <500 km^2). As only a small number of the subpopulations is considered viable, the genetic exchange between those subpopulations is very reduced and they are therefore considered as severely fragmented. The main threat is eutrophication that leads to continuing habitat declines."

"According to the results of new studies (Issakainen et al. 2011) *Najas tenuissima* is present in 16 lakes in Finland. Populations in only three of the lakes were estimated as vital. Only one of the known three occurrences of *N. tenuissima* in the southern Baltic Sea river estuaries is present.

The *Najas* species were previously poorly known in Finland. Even though some new populations have been found recently from new lakes during the work of Issakainen et al. (2011), the species are continuously declining in Finland. Many populations known in the 1960s have disappeared since.

In the Leningrad region it has nearly disappeared from the coast of Neva Bay between St. Petersburg and Sestroretsk where it was abundant 25 to 30 years ago. There are also no recent records from the Vyborg region (Tzvelev 2000)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to World Flora Online (2021), *Najas tenuissima* is the current accepted name for this species.

From Roskov et al. (2020):

Kingdom Plantae
  Phylum Tracheophyta
    Class Liliopsida
      Order Alismatales
        Family Hydrocharitaceae
          Genus *Najas*
            Species *Najas tenuissima* (A.Braun ex Magnus) Magnus

Size, Weight, and Age Range

From Vargot et al. (2016):

"*Najas tenuissima* is an annual aquatic plant, with a length of 8–20 cm, with very brittle stems and thin (0.2–0.5 cm) leaves (Fig. 1B)."

"[…] seeds can maintain their germinability up to 50 years or more […]"

Environment

From Vargot et al. (2016):

"Single recent records have been made among others in ponds, a tectonic lake, backwater of a river. Thus, this species prefers continental lakes, but it grows in various waterbodies and water courses of other types. In general, *Najas tenuissima* prefers fresh, well-warmed waters, sandy or slightly muddy grounds and a lack of water flow; besides it grows in places where there is no competition with other plant species."

"But in that case the main limiting factor for *Najas tenuissima* is the small abundance of suitable lakes (in particular, tectonical and aqueoglacial lakes with clear water and suitable ground or waterbodies with a similar hydrological regime), where competition with other species is minimal."

From Lansdown (2011):

"The species is found in the littoral of lakes down to 1.5 m and on sandy or muddy beds of small ponds or other water bodies near the coast. It needs pure and transparent water and does not cope well with turbidity and pollution (Tzvelev 2000)."

"In most Finnish lakes the populations of *N. tenuissima* are reduced to narrow ribbon-like stands between helophyte vegetation (mainly reed beds, *Phragmites australis*) in the waterfront and dark bottoms in deep water. In some lakes other plants, especially those who can use HCO3 as a carbon supply (e.g. *Elodea canadensis*, *Ceratophyllum demersum*), grow abundantly and replace *Najas* species and other submerged plants."

"It is obvious that the two *Najas* species have narrow habitat requirements which are not fully understood. The most important physical factors for the species are the fine-grained bottom minerals with a thin layer of neutral or slightly alkaline organic mud, and lightness and openness of the bottom. In Finland the light and open bottom area is decreasing constantly due to eutrophication. The most important chemical factor seems to be the lack of carbon dioxide, which is seen as high pH values in the water, and is due to eutrophication and abundant water vegetation. In addition, the presence and abundance of *Najas* species is affected by many interactions between species, eg. allelopathy, the mechanisms of which are not known."

Climate

From Triest (1988):

"[…] *N. tenuissima* are species from cold areas […]."

Distribution Outside the United States

Native

From Vargot et al. (2016):

"*Najas tenuissima* (Hydrocharitaceae) is an endangered relict species with a disjunctive range in Eastern Europe, in the Urals, in Siberia and Kazakhstan, and in the Far East, in Japan. […] The species is known reliably in Fennoscandia, Latvia, Russian Federation (Leningrad region, Novgorod region, Tver region, Ryazan region, Republic of Mordovia, Sverdlovsk region, Chelyabinsk region, Irkutsk region, Amur region, Krasnoyarsky Krai and Primorsky Krai), Northern and Eastern Kazakhstan and Japan."

Vargot et al. (2016) provides a table (Appendix 1 of source material) with the following distribution information:
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From Shiga et al. (2020):

"Distribution. Khar-Us Lake (No. 1) in Mongolia; also found in Finland, Japan, Kazakhstan (North and East), Latvia, and Russia."

Introduced

No records of introductions were found for *Najas tenuissima*.

One source, Plants of the World Online (2020), reports *N. tenuissima* has been introduced to Kazakhstan however, no specific reference was given for the classification and the most recent source for the species' page is dated 2008. A more recent and comprehensive examination of the range of *N. tenuissima* was given in the literature by Vargot et al. (2016) which included Kazakhstan in the native range of the species. Because this species occurs in disjunctive waterbodies across a broad geographic scale, most collections of the species are close to over 100 years old, and recently, it can be rare, its native range is not well understood (Vargot et al. 2016). As Vargot et al. (2016) is the most recent, comprehensive, study of the species' range appearing in the peer-reviewed literature this screening will follow the description of the native range found within.

From Vargot et al. (2016):

"It is difficult to judge on the appearance of new populations in Chelyabinsk region, Irkutsk region, Amur region, Republic of Mordovia. It is not excluded that the species aims to occupy new territories, like, for example, *Najas major* All. and *N. minor*. But in that case the main limiting factor for *Najas tenuissima* is the small abundance of suitable lakes (in particular, tectonical and aqueoglacial lakes with clear water and suitable ground or waterbodies with a similar hydrological regime), where competition with other species is minimal."

Means of Introduction Outside the United States

No records of introductions were found for *Najas tenuissima*.

Short Description

From Vargot et al. (2016):

"*Najas tenuissima* is an annual aquatic plant, with a length of 8–20 cm, with very brittle stems and thin (0.2–0.5 cm) leaves […]. The leaf sheaths have an irregularly-toothed shoulder. This species differs of other members of the genus *Najas* due to the sculpture of the seedcoat that consists of 25–30 rows of cells elongated in lengthwise direction (the length of the cells exceeds the width 2–7 times). The seeds are 2–3 mm in length, oblong-elliptic […]."

From Triest (1988):

"*Plants* submerged, monoecious, slender. Stems unarmed, 0.5 mm in diameter. Leaves 7-20 mm long, flat, acute, linear-lanceolate, 0.4-0.5 mm wide (incl. teeth on both sides), 0.23-0.29 mm wide (excl. teeth on both sides) ; margin on each side serrulate with 8-11 conspicuous spiny teeth on small excrescences ; leaf teeth 0.09-0.11 mm long ; the ratio of teeth length to leaf width being 0.30-0.46 ; midrib without spines ; septa absent ; fibres absent ; leaf sheath truncate, lacerate to shortly auricled 1.3-2.4 mm (incl. spine-cells) by 1.4-1.9 mm (ratio = 1.1-1.3), serrulate or lacerate with 4-6 spine-cells on each side, the auricle being 0.19-0.32 mm long (incl.

spine-cells) and 0.48-0.7 mm wide (ratio = 0.4-0.46(-0.67), serrulate or lacerate with 4-6 spine-cells on each side but no [sic] on the inner edge ; apex of the auricle rather obtuse.

Inflorescences axillary, male and female flowers at different nodes, but the male ones more to the top of the plant or together at the same nodes on the top of the plant. *Male flower* enclosed in a spathe, 1-1.2 mm (incl. neck of spathe) by 0.2 mm, which tapers at the top, bearing brownish spine-cells on the apex ; inner envelope protruding 0.15-0.17 mm above the anther ; anther 0.6-0.7 mm by 0.15-0.18 mm, unisporangiate. *Female flower* naked ; ovary 0.7-1.3 mm by 0.2-0.52 mm; style and stigma 0.7-1.2 mm ; stigma 2-3- lobed.

Fruit with persistent, thin, membraneous pericarp and the remaining parts of the style. *Seed* straight, elliptical oblong, (2.2)-2.5-2.8(-3) mm by 0.46-1.0 mm (ratio = 3.2-5) ; testa smooth, with aréoles rather irregularly arranged in longitudinal rows, each row of 25-30(-35) ; areoles rather irregularly shaped, longer than broad, 0.06-0.16 mm long and c. 0.032 mm wide; cell walls not raised."

Biology

From Vargot et al. (2016):

"*Najas tenuissima* is a monoecious plant. The small, inconspicuous flowers are formed in leaf sheaths. It blooms in June, fructifies in August (Lisitsyna et al., 2009)."

"It is necessary to provide an annual monitoring of waterbodies – habitats of *Najas tenuissima*, because of the nature of the life cycle of aquatic annuals, this species (under different weather conditions in different years) can either grow in mass or remain in the seed phase in the bottom soil of the waterbody; these seeds can maintain their germinability up to 50 years or more (authors' observations)."

Human Uses

No human uses were found for *Najas tenuissima*.

Diseases

No records of diseases were found for *N. tenuissima*.

Threat to Humans

No threats to humans were found for *Najas tenuissima*.

3 Impacts of Introductions

No records of introductions were found for *Najas tenuissima*; therefore, there is no information on impacts of introduction. See 'Introduced' above for discussion of two instances of reported introductions and why they are not considered such in this screening.

4 History of Invasiveness

The history of invasiveness for *Najas tenuissima* is classified as no known nonnative population. The native range of *N. tenuissima* has not been well understood (Vargot et al. 2016). The native range of *N. tenuissima* is disjunctive across a broad geographic scale, most collections of the species are close to over 100 years old, and recently, the plant has become rare. Recent collections of this species in areas not previously reported are believed to be within the native range of the species and not nonnative introductions.

5 Global Distribution

Figure 1. Known global distribution of *Najas tenuissima*. Observations are reported from Finland, Latvia, Russia, Ukraine, and North Korea. Map from GBIF Secretariat (2020). Observations from Ukraine and North Korea were not used as source points in the climate match analysis as no records of established populations were found for these locations.

Figure 2. Additional locations where *Najas tenuissima* has been reported in Europe and Asia. Locations are in Finland, Latvia, Russia, Kazakhstan, and Hokkaido, Japan. Map from Vargot et al. (2016), licensed under Creative Commons BY-NC.

Additional locations in Latvia, Kazakhstan, Mongolia, and Russia found in Suško (2008), Vargot et al. (2016), and Shiga et al. (2020) were used as supplemental source points in the climate match analysis.

6 Distribution Within the United States

No records of *Najas tenuissima* in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Najas tenuissima* in the contiguous United States was highest in the northern States from Michigan to North Dakota and in portions of the Rocky Mountain region. The Northeast, Midwest, Northern Great Plains and Interior West regions largely had a medium to high climate match. The Southeast, Pacific Coast, and southern Great Plains largely had a low climate match. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.260, high (scores of 0.103 and greater are classified as high). Half the States had high individual Climate 6 scores. The following States had medium individual scores: Arizona, Idaho, Indiana, Maryland, North Carolina, and Tennessee. The following States had low individual scores: Alabama, Arkansas, California, Delaware, Florida, Georgia, Kansas, Louisiana, Missouri, Mississippi, Nevada, Oklahoma, Oregon, Rhode Island, South Carolina, Texas, and Washington.

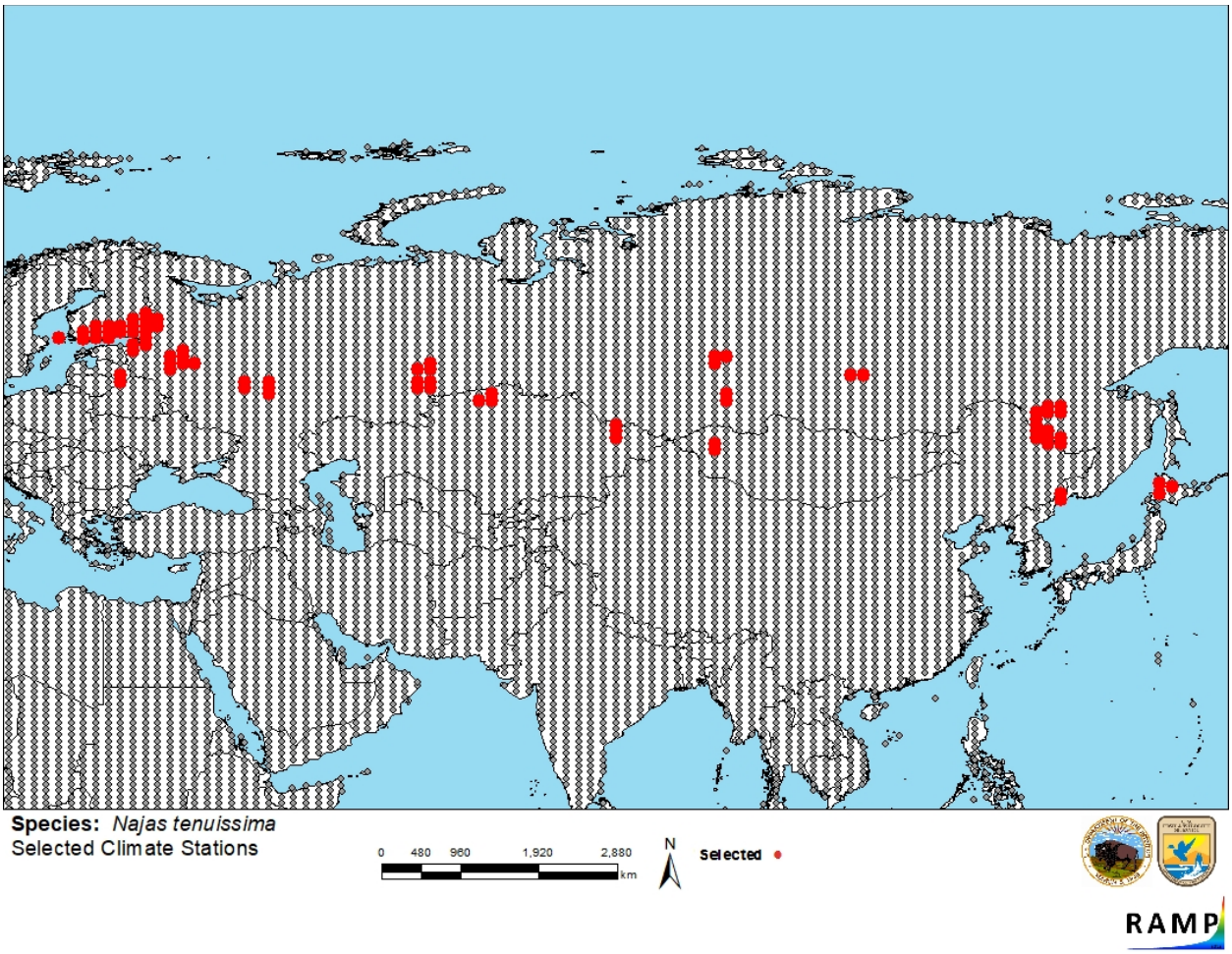

Figure 3. RAMP (Sanders et al. 2018) source map showing weather stations in Eastern Europe and Asia selected as source locations (red; Finland, Latvia, Belarus, Russia, Kazakhstan, Mongolia, Japan, North Korea) and non-source locations (gray) for *Najas tenuissima* climate matching. Source locations from Suško (2008), Vargot et al. (2016), GBIF Secretariat (2020), and Shiga et al. (2020). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

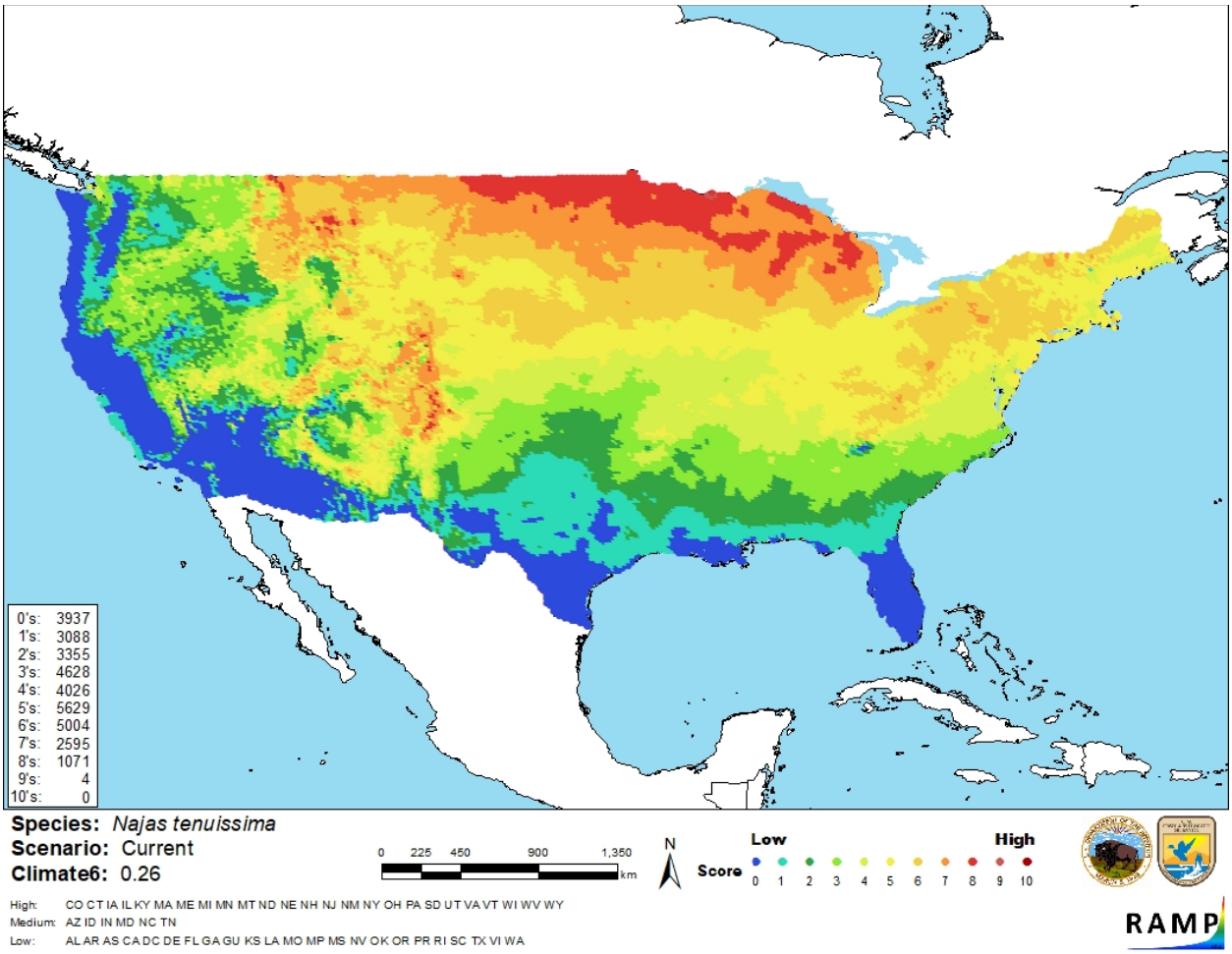

Figure 4. Map of RAMP (Sanders et al. 2018) climate matches for *Najas tenuissima* in the contiguous United States based on source locations reported from Suško (2008), Vargot et al. (2016), GBIF Secretariat (2020), and Shiga et al. (2020). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

The certainty of assessment for *Najas tenuissima* is low. There was limited ecological and biological information available for this species, and due to its rarity, georeferenced locations for all occurrences within its native range were sparse. There are no introductions of *N. tenuissima*, therefore there is no information on impacts of introductions. *N. tenuissima* is in decline in its

native range, possibly limited by narrow habitat requirements. It is unclear to what degree these environmental conditions are present in the contiguous United States further reducing the certainty of this assessment.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Najas tenuissima is a rare monoecious annual aquatic plant found in the littoral zones of lakes and other disjunctive waterbodies in Eastern Europe, across Russia, and in Japan. *N. tenuissima* has narrow habitat requirements, tectonical and aqueoglacial lakes with clear water and sandy or muddy bottoms. Given this species' apparent rarity and distribution across a broad geographic scale, its native range is not well understood. There are no records of introduction of *N. tenuissima*. Recent additional observations are considered to be part of the native range of the species. The history of invasiveness is no known nonnative population. The overall climate match for the contiguous United States was high, with the highest scores observed in the northern Midwest and in portions of the Rocky Mountain region. The certainty of assessment for *N. tenuissima* is low due to a still evolving understanding of the native range and lack of information pertaining to the history of invasiveness. The overall risk assessment category for *N. tenuissima* is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): No Known Nonnative Population**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks, Important additional information: No additional remarks**
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 11.

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11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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Tzvelev NN, editor. 2000. Red data book of nature of the Leningrad Region. Volume 2: Plats and fungi. St. Petersburg, Russia: World and Family.