Flowering Rush (*Butomus umbellatus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, January 2015
Revised, January 2018
Web Version, 9/10/2018

Photo: Pavel Šinkyřík. Image has been released to Public Domain by P. Šinkyřík. Available: https://www.biolib.cz/en/image/id94639/. (January 10, 2018).

1 Native Range and Status in the United States

Native Range

From Cao et al. (2018):

"Africa, Asia, and Eurasia (USDA NRCS, 2008)"

Butomus umbellatus is native to Afghanistan, Albania, Algeria, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, China, Croatia, Czech Republic, Denmark,

Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Iraq, Ireland, Israel, Italy, Jordan, Kazakhstan, Latvia, Lebanon, Lithuania, Republic of Moldova, Mongolia, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia and Montenegro, Spain, Sweden, Switzerland, Syrian Arab Republic, Turkey, Turkmenistan, Ukraine, United Kingdom, and Uzbekistan (GISD 2018).

Status in the United States

Butomus umbellatus is listed as potentially invasive and banned in Connecticut, a Class B noxious weed in Vermont, and a wetland and aquatic weed quarantine in Washington (USDA, NRCS 2018).

From Cao et al. (2018):

"First observed in 1897 in North America. Widespread in the northeast US. Locally abundant in northern US. Recorded in: CT, ID, IL, IN, ME, MI, MN, MT, ND, NE, NY, OH, PA, SD, VT, WI (USDA NRCS, 2008) […]."

"**Great Lakes Region:** It was first collected near Laprairie on the St. Lawrence River in 1905; a specimen in the Britton Herbarium at the New York Botanical Garden was collected September 16, 1906, by Fr. Louis Arsene on the borders of the St. Lawrence River. West of Niagara Falls, the taxon was first collected near Detroit (Wayne County, Michigan, in Brownstown Township and at River Rouge) in 1930 by O. A. Farwell, although he noted on the specimen, "Has been here since before 1918!!!" (R. L. Stuckey 1968). Studies of *Butomus* in North America (L. C. Anderson et al. 1974) indicated that apparently the genus has become naturalized in North America at two separate locations, one near Detroit and another in the St. Lawrence River region. It is possible that plants naturalized in the St. Lawrence River region originated in eastern Asia, and those naturalized in the Detroit area originated in Europe or western Asia. Stuckey (1994) included dots for *B. umbellatus* from Indiana and British Columbia. Now widespread in Great Lakes region."

"*Butomus umbellatus* is a prohibited species in Illinois, Michigan, and Minnesota, and is restricted in Wisconsin (GLPANS 2008). A recent survey of Minnesota Nursery and Landscape Association Members revealed that 80% of respondents were incorrect or unsure of the non-native character of *B. umbellatus* despite its prohibited status in Minnesota (Peters et al. 2006)."

From NatureServe (2018):

"It is actively expanding its range in North America. In the last 35 years the species has spread in a sporadic manner from a limited area around the Great Lakes and St. Lawrence River. It is sold commercially but is banned in some states."

"It is illegal to buy or sell it in Minnesota (Proulx 2000). […] Species on the Prohibited Plant List for 2004 for the states of New Hampshire, Vermont and Washington (Ponds, Plants and More 2004)."

Means of Introductions in the United States

From Cao et al. (2018):

"*Butomus umbellatus* was intentionally brought to North America from Europe as a garden plant for ornamental purposes. Ship ballast has also been cited as a potential vector for the initial introduction.

It can be spread over long distances by garden planting, and once established in a watershed, it spreads locally by rhizomes and by fragmentation of the root system. Muskrats reportedly use parts of the plant and contribute to its local spread, though the importance of this particular vector in spreading has not been investigated (Staniforth and Frego 1980). Populations may be spread via the horticulture trade (Lui et al. 2005), and boaters can also transport flowering rush on their equipment. Water and ice movements can easily carry it to new areas of a water body (Proulx 2000)."

Remarks

From Cao et al. (2018):

"The name *Butomus umbellatus* forma *vallisneriifolius* (Sagorski) Glück has been used for plants that grow totally submersed or have floating leaves. Field transplant experiments with North American plants (R. L. Stuckey et al. 1990) have demonstrated that the non-flowering submersed form can be converted to a flowering mudflat form, and that flowering terrestrial plants can be transformed into non-flowering submersed ones. Consequently, *B. umbellatus* f. *vallisneriifolius* is a deep-water growth form and should have no taxonomic systematic status. A map of *Butomus* in North America, prepared by R. L. Stuckey (1994), showed that he accepted two species. His map essentially had everything east of Niagara Falls as *B. junceus* and everything west of the Falls [*sic*] as *B. umbellatus*. At this time, experts do not accept two species in the genus."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

"Kingdom Plantae
Subkingdom Viridaeplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnolipsida
Superorder Lilianae
Order Alismatales
Family Butomaceae
Genus *Butomus* L.

Species *Butomus umbellatus* L."

"Taxonomic Status:
Current Standing: accepted"

Size, Weight, and Age Range

From Swearingen and Bargeron (2016):

"This plant can reach from 1-5 ft. (0.3-1.5 m) in height […]"

"The leaves are linear, up to 3.2 ft. (1 m) long […]"

Environment

From Swearingen and Bargeron (2016):

"[…] can survive in water of up to 9.8 ft. (3 m) deep. It does not tolerate salt water."

From GISD (2018):

"Flowering rush grows well in light (sandy), medium (loamy) and heavy (clay) soils. The plant prefers acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It requires wet soil and can grow in water (Plants for a Future, UNDATED)."

Climate/Range

From Akhani and Zehzad (2014):

"This species cannot tolerate warm climate."

Distribution Outside the United States

Native

From Cao et al. (2018):

"Africa, Asia, and Eurasia (USDA NRCS, 2008)"

Butomus umbellatus is native to Afghanistan, Albania, Algeria, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, China, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Iraq, Ireland, Israel, Italy, Jordan, Kazakhstan, Latvia, Lebanon, Lithuania, Republic of Moldova, Mongolia, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia and Montenegro, Spain, Sweden, Switzerland, Syrian Arab Republic, Turkey, Turkmenistan, Ukraine, United Kingdom, and Uzbekistan (GISD 2018).

Introduced
From GISD (2018):

"Flowering rush, *B. umbellatus* was discovered in 1905 near Montreal and was present near Quebec City as early as 1922. During the last 50 years, the spatial distribution of this species did not expand much, although some colonies became established in the Gaspe´ Peninsula and in the Lake St Jean area. Between 1926 and 1950, flowering-rush and purple loosestrife *Lythrum salicaria* spread rapidly along the St Lawrence River."

Akhani and Zehzad (2014) list *Butomus umbellatus* as introduced to Canada and Ireland.

DAISIE (2018) lists *Butomus umbellatus* as alien and not established in the European part of Russia and as alien and established in Ireland.

Means of Introduction Outside the United States

From Haber (1998):

"Its spread to western Canada is known to have occurred as the result, at least in part, of deliberate introductions of eastern "bulbs"."

Short Description

From GISD (2018):

"Flowering rush is described as a moderately tall, rush-like perennial. Its leaves are basal originating from a stout rhizome that is stiff and erect when immersed or lax and floating when in deep water. The inflorescence is a many-flowered umbel borne on a scape 1 to 1.5m tall. The flowers are perfect, regular, 2-3cm across, and pink. There are 3 sepals, which are petaloid. There are 3 petals, 9 stamens, with elongate anthers. Flowering rush has 6 pistils that are simple, whorled, and united at the base. The fruit is an indehiscent, many-seeded capsule (USGS-NPWRC, 1999)."

From Jacobs et al. (2011):

"Flowering rush has triangular leaves like a sedge (Cyperaceae) and round flowering stems like a rush (Juncaceae), but it is neither. It is a Butomaceae, and it is the only representative species of this taxonomic family. […] The narrow leaves are triangular in cross section […]; spongy and compressible, and emerged leaves are twisted spirally toward the leaf tip."

"The flowers […] are three-quarters to one inch wide (2.0 to 2.5 centimeters) with three small, slightly-greenish sepals, six pink to rose-colored petals, nine stamens in two whorls (the outer whorl has six and the inner whorl has three), and six pistils that can produce about 200 seeds each. Twenty to 50 flowers are clustered in a round, umbrella-shaped inflorescence […] atop a stalk that is round in cross section."

Biology

From Cao et al. (2018):

"*Butomus umbellatus* grows in lakes, riparian zones, water courses, wetlands, and marshes. It can tolerate water as deep or deeper 2 meters, where cattail is normally found, and can extend to the deepest range of native emergent marsh species (except possibly for hard-stem bulrush and wild rice). Once established in a marsh, populations tend to increase and persist indefinitely. Water level fluctuations may promote the spread of *B. umbellatus*, allowing populations to expand when water levels are low and the soil surface is exposed and warmed (Hroudová et al. 1996). However, severe or long-lasting decreases in water level could result in the reduction of *B. umbellatus* populations (e.g., Hudon 2004). It is intolerant of salt or brackish water. *Butomus umbellatus* is a perennial plant. It is in flower from July to September, and the seeds ripen from August to September (in North America). The scented flowers are hermaphroditic and are pollinated by bees, flies, and lepidopterans. Although Canadian populations of *B. umbellatus* appeared to be incapable of autonomous seed production (without external pollination assistance), plants were self compatible [*sic*] and produced more seed when self-pollinated (Eckert et al. 2000).

Flowering rush can be fertile (both spread by sexual reproduction and seeds or by vegetative means) or sterile (can only reproduce by vegetative means (Lui et al. 2005, Parkinson et al. 2010). Diploid populations of *B. umbellatus* can reproduce sexually via seed production and clonally via the branching and fragmentation of rhizomes and the production of small bulbils on both the rhizomes and inflorescences (Lui et al. 2005). Most *B. umbellatus* populations in the Great Lakes are diploid and capable of producing abundant viable seed, although the major method of reproduction appears to be clonal (Lui et al. 2005). Sterile triploid populations of *B. umbellatus* also exist in the Great Lakes region. North American triploid populations rarely flower and also have a limited ability to multiply and disperse via clonal reproduction, although they may have a greater ecological tolerance than diploid populations as a result of polyploidy or of greater investment in vegetative growth (Lui et al. 2005). Triploid populations also appear to be spread more commonly through the horticulture trade. Lui et al. (2005) suggested that these different reproductive strategies are indications of two different forms of *B. umbellatus* in North America with different life histories and invasion histories.

Diploid and triploid populations of *B. umbellatus* exist throughout its global range, although reproductive traits and strategies may differ by region (e.g., North American vs. European populations) (Hroudová and Zákravský 1993, Lui et al. 2005). Relative to native European populations, Brown and Eckert (2005) found that nonindigenous North American diploid populations invested much more biomass in reproduction and were more likely to produce both inflorescences and clonal bulbils. Post-establishment survival was also over twice as high for North American populations as it was for European populations (Brown and Eckert 2005)."

Human Uses

From GISD (2018):

"Flowering rush tuber can be cooked. It should be peeled and the rootlets removed. The root can also be dried and ground into a powder; it can then be used as a thickener in soups etc, or be

added to cereal flours when making bread. It contains more than 50% starch (Plants for a Future, UNDATED)."

From Akhani and Zehzad (2014):

"In Europe this is an ornamental aquatic plant using [*sic*] in ponds and water gardens."

Diseases

From Harms and Shearer (2015):

"Sixteen percent of all plants displayed disease symptoms consisting of leaf discoloration, lesions, or spots […]. Ten fungal isolates were obtained from tissues. Of these, five could not be identified because they did not sporulate. Four were moniliaceous (hyaline hyphae) Ascomycetes, and one was a dematiaceous (dark hyphae) Ascomycete. The remaining isolates were determined to be *Pestalotiopsis guepinii* (Desm.) Steyaert, *Virgaria nigra* (Link) Nees, *Hansfordia ovalispora* S. Hughes, *Fusarium oxysporum* Schlecht., and a *Phoma* sp."

Threat to Humans

From Jacobs et al. (2011):

"Flowering rush supports habitat for the great pond snail that hosts parasites that cause swimmers' itch."

3 Impacts of Introductions

From Swearingen and Bargeron (2016):

"*Butomus umbellatus* can displace native riparian vegetation. It can form dense stands which are an obstacle to boat traffic. It is tolerant of a wide range of temperatures which gives it the potential to invade across much of the United States."

From NatureServe (2018):

"It appears to outcompete the willows and cattails in Idaho."

"*B. umbellatus* is listed as one of the invasive plant species that threatens *Neobeckia aquatica* currently listed as S1 [critically imperiled] in Vermont."

"*B. umbellatus* "impacts habitat and recreation along lake and river shorelines" in Montana (Rowland [et al.] 2002)."

From Brown and Eckert (2005):

"The impacts of *B. umbellatus* have not been formally studied, but the species can dominate the emergent aquatic vegetation under a wide range of ecological conditions (Zenkert, 1960; Roberts, 1972), inhibit industrial and recreational uses of shallow waters (Boutwell, 1990; Les

and Mehrhoff, 1999), and threaten native littoral species like *Zizania aquatica* (wild rice), an economically important plant (B. Ranta, Ontario Ministry of Natural Resources, personal communication)."

From Lavoie et al. (2003):

"Although there is a high number of dense flowering-rush [*Butomus umbellatus*] populations along the St Lawrence River, this species has not demonstrated a strong impact on wetland plant diversity, at least in comparison with common reed and reed canary grass."

From Dietz (2015):

"In these wetlands [Flathead Lake region, Montana], *B. umbellatus* has altered native habitat structure by forming stands in areas that were formerly open water. These newly vegetated areas reduce habitat for native fish species that prefer vegetated waters, and lead to increased spread of invasive fish species such as Northern Pike and Largemouth Bass that use the dense stands as cover in ambush hunting of prey (Parkinson et al. 2010)."

"The observed 69% decrease in biomass of native wetland communities exposed to growing *B. umbellatus* nodules compared to those without nodules is the first documented impact of this invasive on native wetland restoration. These reductions in seedling growth due to direct competition from live stands of *B. umbellatus* are similar to the effects of other exotic grass and forb species shown to impact forested and prairie ecosystems (Jordan et al. 2008, Grman and Suding 2010, Grove et al. 2012)."

From Jacobs et al. (2011):

"Flowering rush growing prolifically in irrigation ditches reduces water flow and distribution, and increases ditch maintenance costs […]. Plants interfere with boat propellers, swimming, and fishing thus reducing recreational opportunities along rivers and lake shores. Flowering rush supports habitat for the great pond snail that hosts parasites that cause swimmers' itch.

Fish habitat is affected where flowering rush forms dense stands in previously un-vegetated or sparsely-vegetated aquatic environments. This is a disadvantage for native cutthroat and bull trout that require open water to spawn, and an advantage to introduced fish like largemouth bass, yellow perch, and northern pike that spawn in vegetated substrata. Ambush piscivors [*sic*] (fish-eating fish) such as largemouth bass and northern pike hide in flowering rush vegetation. Northern pike are significantly depredating cutthroat and bull trout in the Flathead Lake and impairing their recovery."

4 Global Distribution

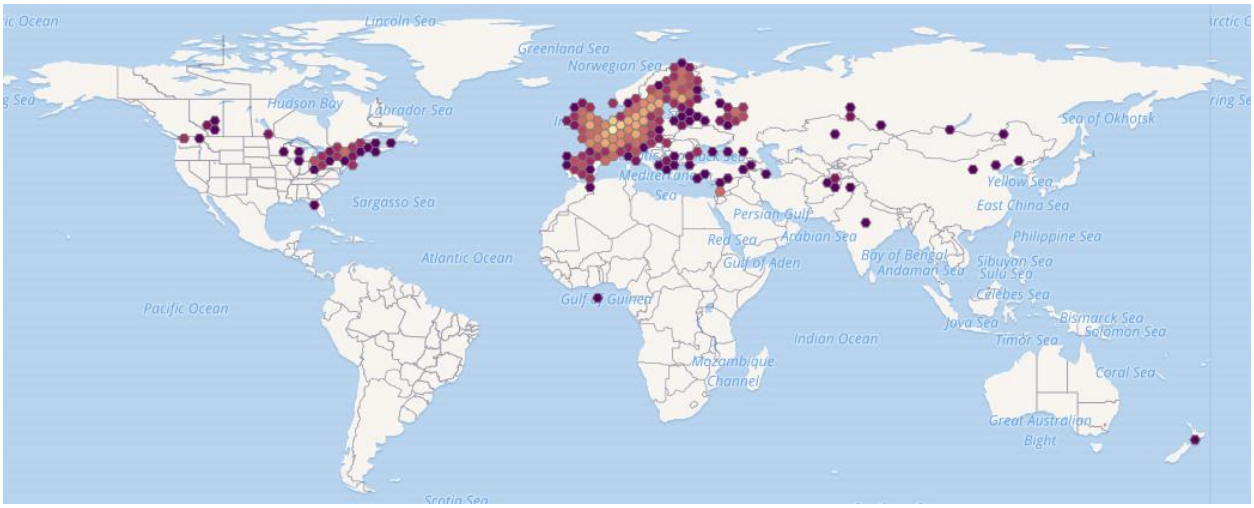

Figure 1. Known global distribution of *Butomus umbellatus*. Locations are in North America, Europe, and Asia. Map from GBIF Secretariat (2018).

The location in Florida may be from a laboratory specimen (GBIF Secretariat 2018). No other sources mention a population in Florida and some sources say that *Butomus umbellatus* cannot survive in warm climates (Akhani and Zehzad 2014). This location most likely does not represent an established population and was not used as a source point for the climate match.

The location in New Zealand is the result of a herbarium specimen. The location shown is the University that houses the specimen and not where the plant was collected (GBIF Secretariat 2018). This location was not used as a source point for the climate match.

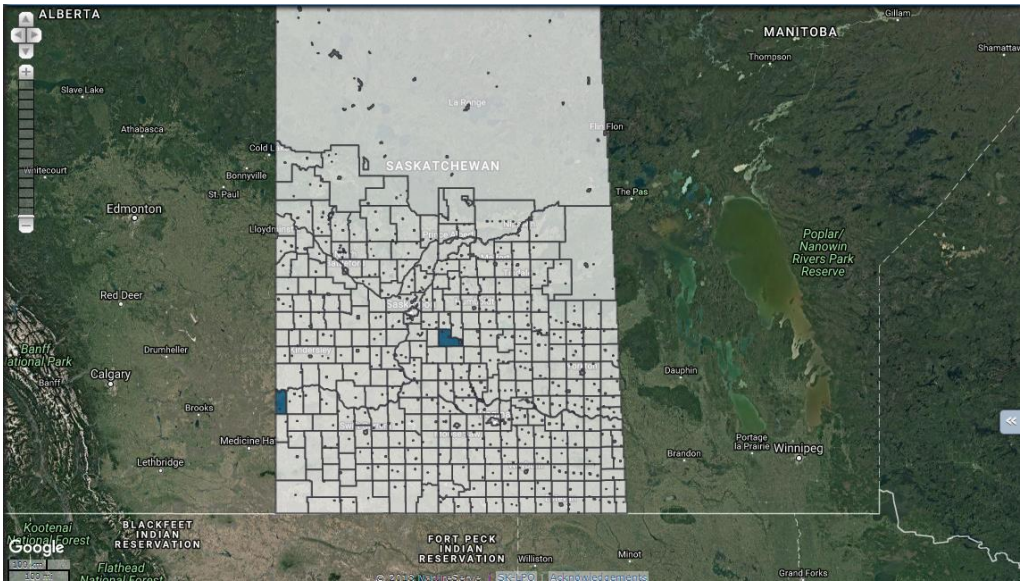

Figure 2. Known distribution of *Butomus umbellatus* in the Canadian province of Saskatchewan. Map from NatureServe (2015).

5 Distribution Within the United States

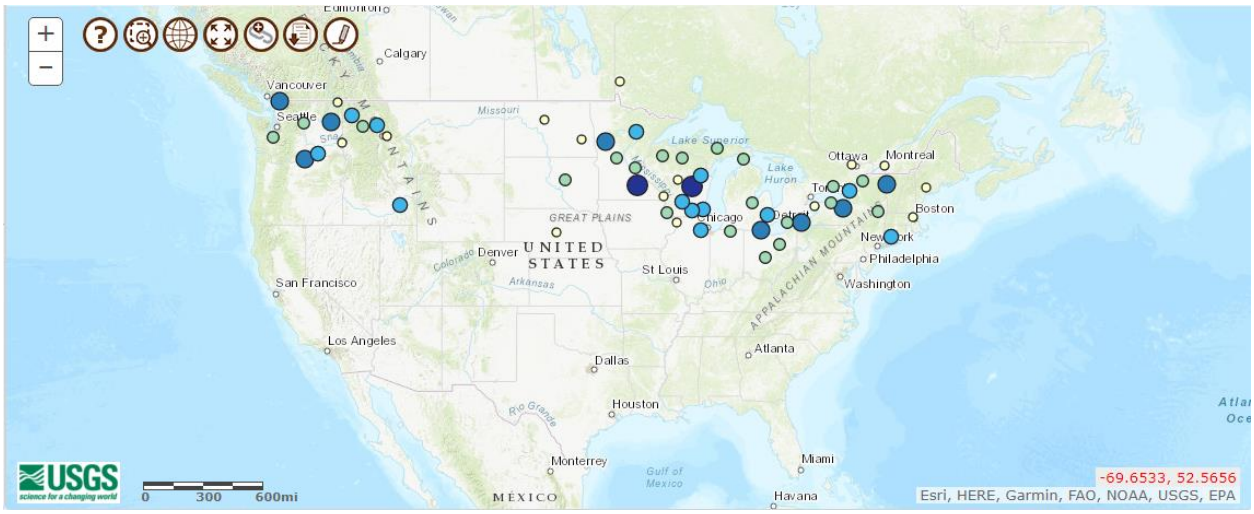

Figure 3. Known distribution of *Butomus umbellatus* in the United States. Map from Cao et al. (2018).

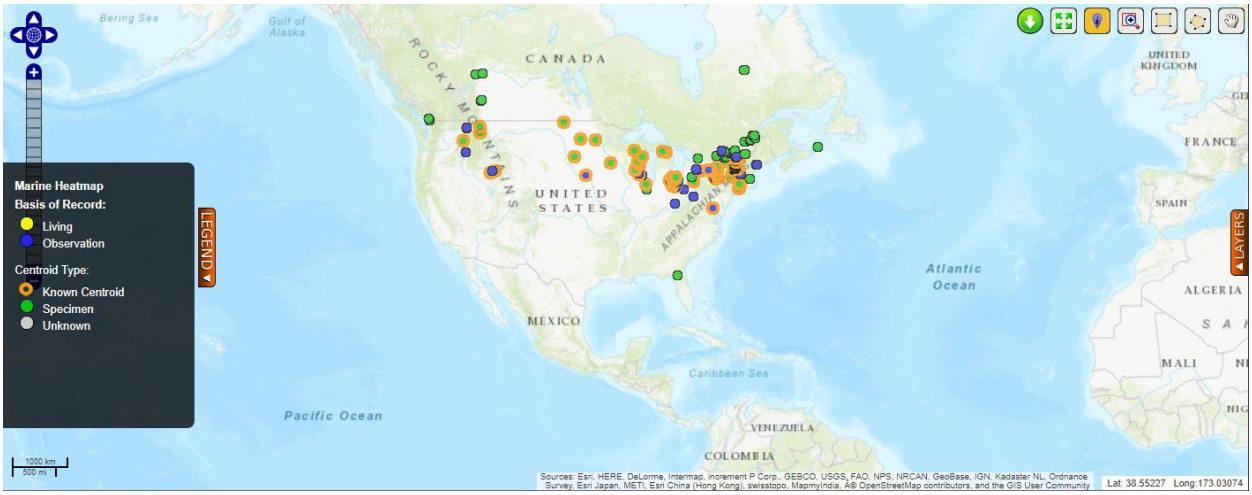

Figure 4. Known distribution of *Buttomus umbellauts* in the United States. Map from BISON (2018).

The location in Florida may be from a laboratory specimen (GBIF Secretariat 2018). No other sources mention a population in Florida and some sources say that *Butomus umbellatus* cannot survive in warm climates (Akhani and Zehzad 2014). This location most likely does not represent an established population and was not used as a source point for the climate match.

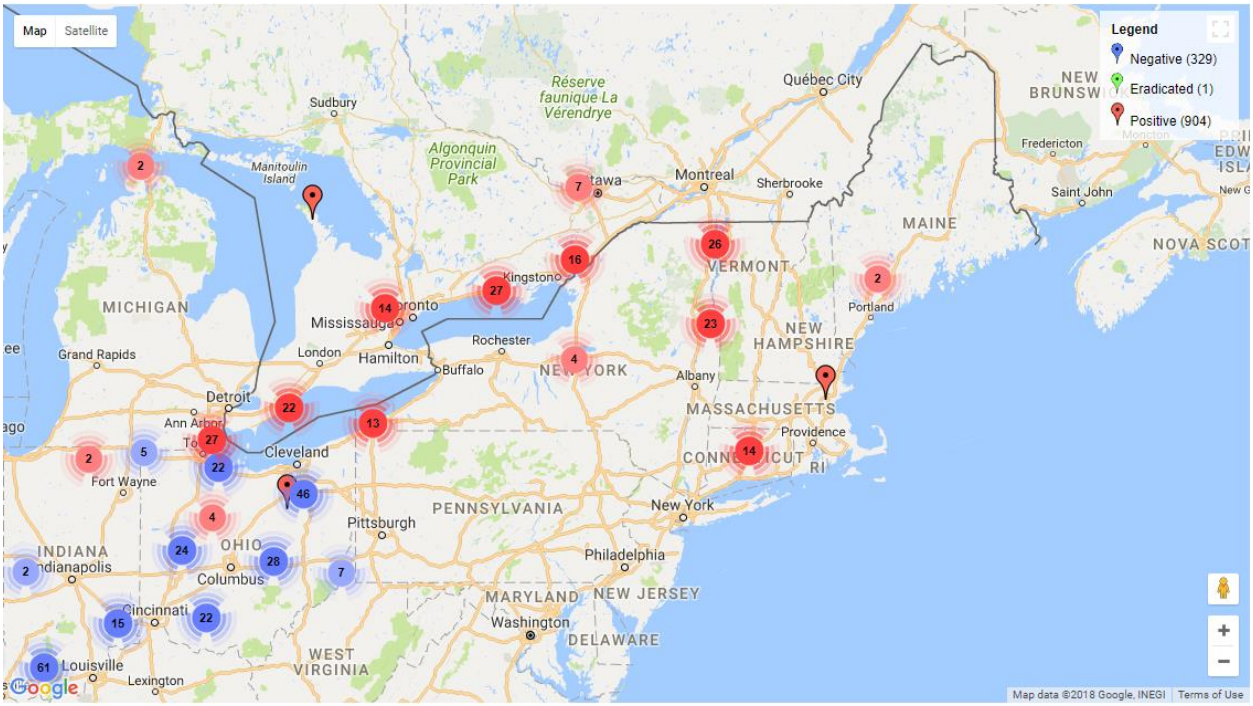

Figure 5. Known distribution of *Butomus umbellatus* in the northeast and southern Great Lakes of the United States. Points show the resutls of field surveys where the species was either present (red) or absent (blue). Map from EDDMapS (2018).

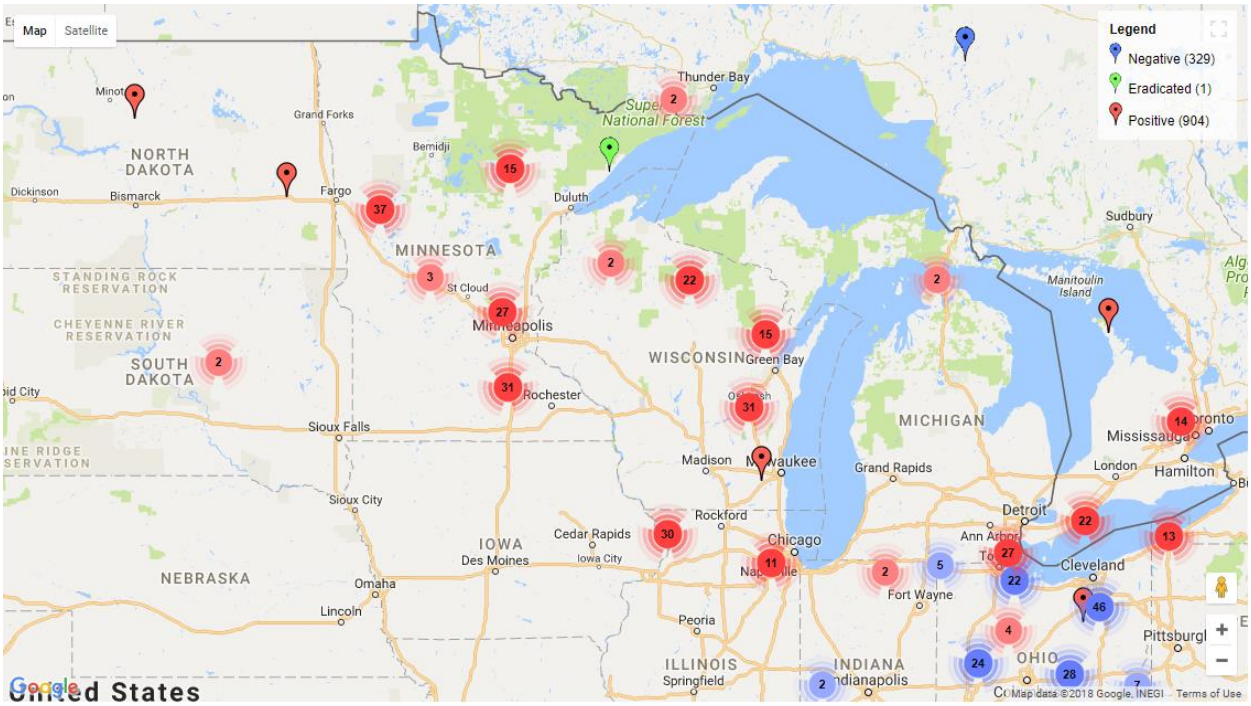

Figure 6. Known distribution of *Butomus umbellatus* in the midwest and western Great Lakes of the United States. Points show the resutls of field surveys where the species was either present (red) or absent (blue). Map from EDDMapS (2018).

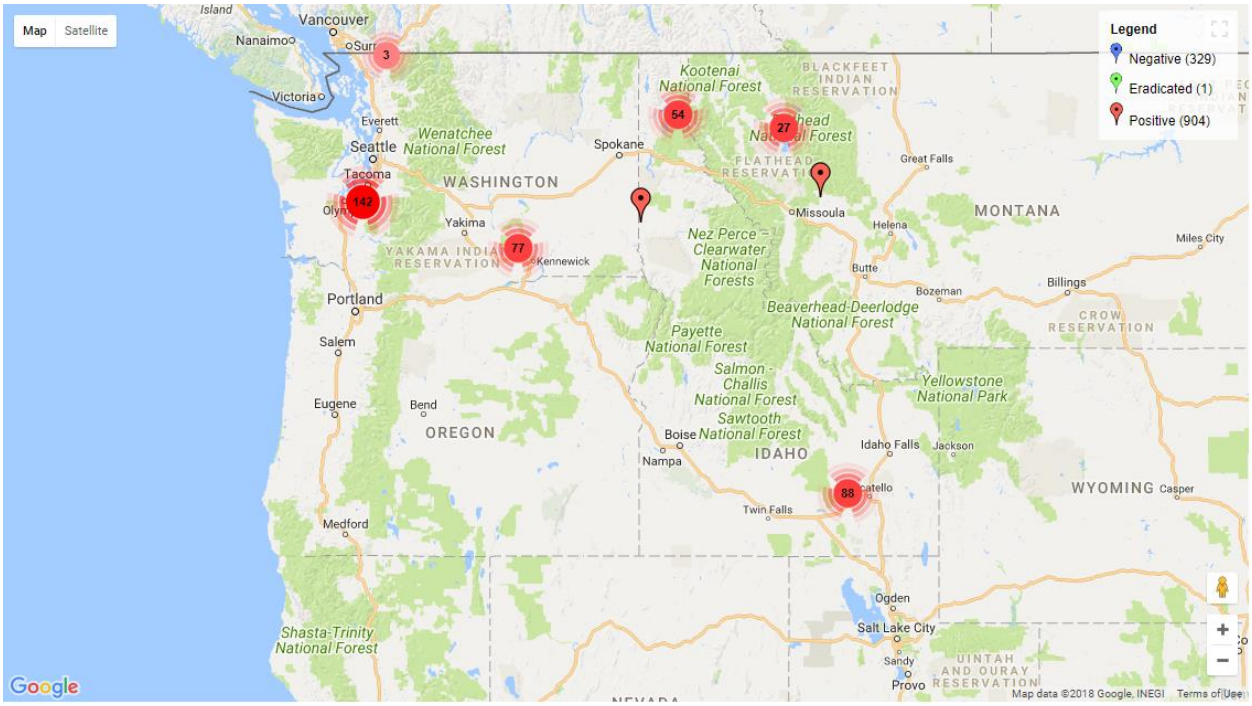

Figure 7. Known distribution of *Butomus umbellatus* in the northwest United States. Map from EDDMapS (2018).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Butomus umbellatus* was generally high across the contiguous United States. Florida, areas along the Gulf Coast, and small pockets in the southwest and Pacific northwest had low matches which quickly transition to high matches moving away from those locations. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous United States was 0.736, high. All states had high individual Climate 6 scores except for Alabama and Georgia which had medium scores, and Florida, Louisiana, and Mississippi which had low scores.

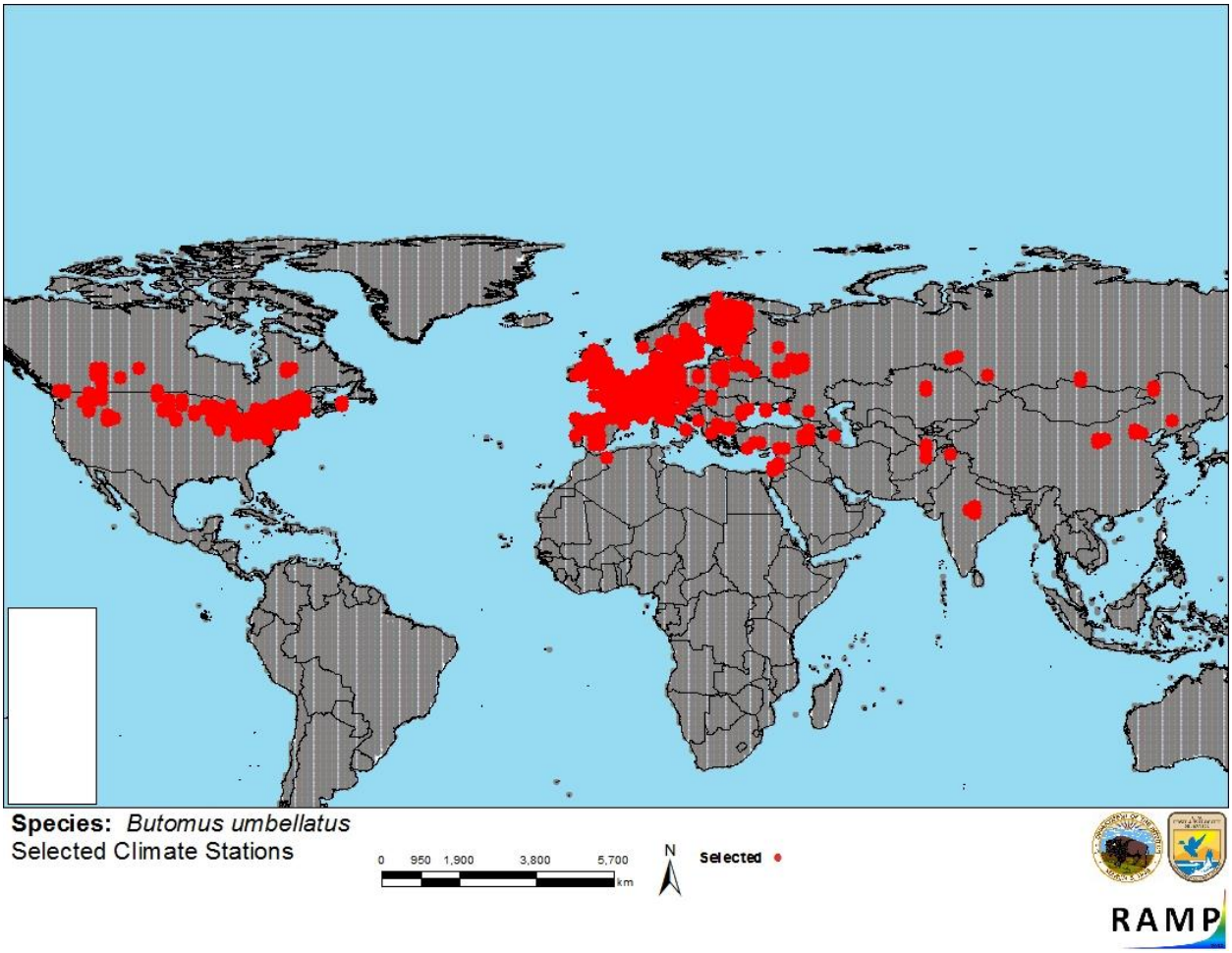

Figure 8. RAMP (Sanders et al. 2014) source map showing weather stations across the world selected as source locations (red) and non-source locations (gray) for *Butomus umbellatus* climate matching. Source locations from BISON (2018) and GBIF Secretariat (2018).

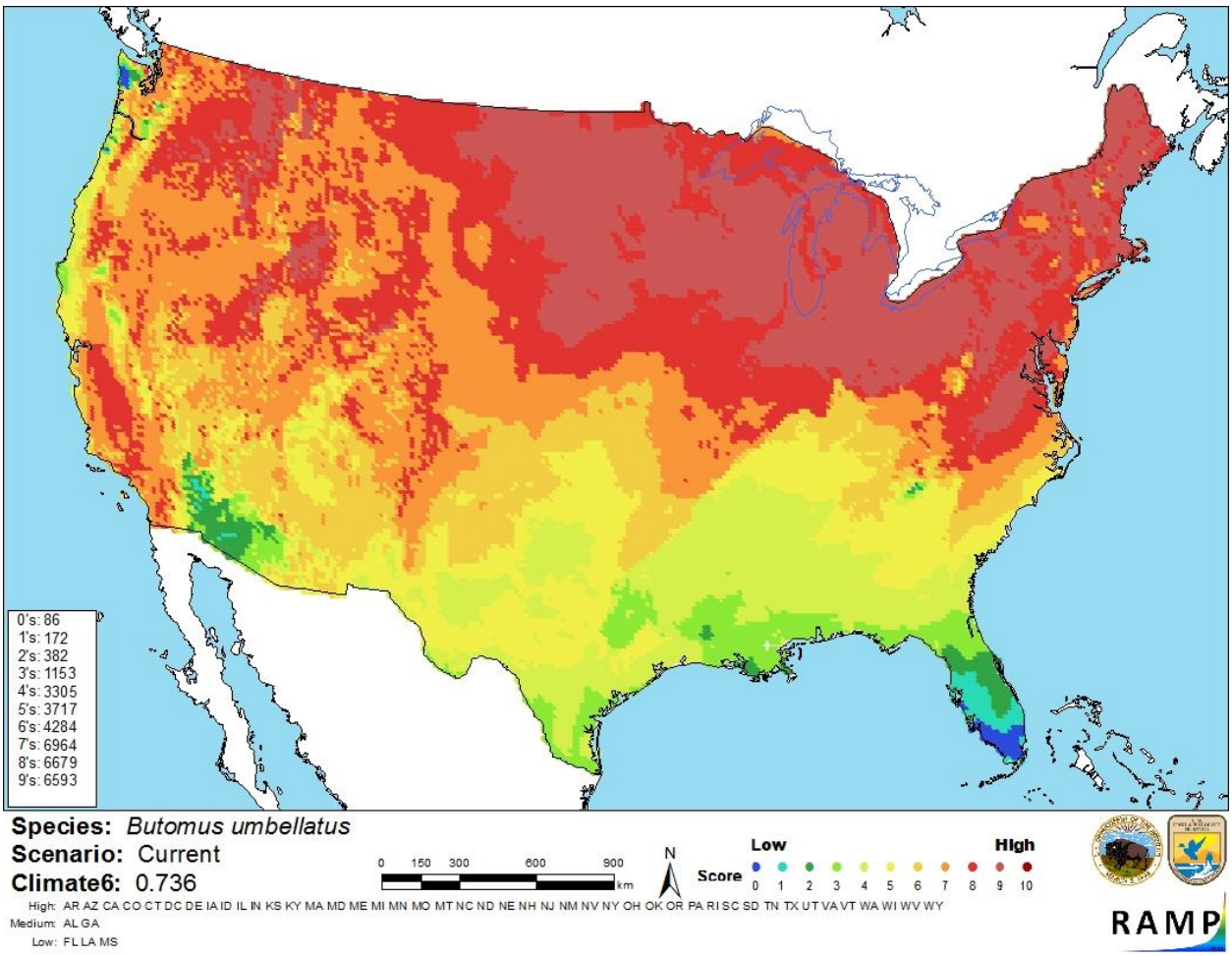

Figure 9. Map of RAMP (Sanders et al. 2014) climate matches for *Butomus umbellatus* in the contiguous United States based on source locations reported by BISON (2018) and GBIF Secretariat (2018). 0 = Lowest match, 10 = Highest match. Counts of climate match scores are tabulated on the left.

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

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

The certainty of assessment for *Butomus umbellatus* is medium. A good amount of quality information on the biology and ecology of this species is available. Most of the information regarding actual impacts of the introductions comes from agency reports and not peer reviewed literature.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness for *Butomus umbellatus* is high. *B. umbellatus* has been introduced in many parts of the world as an ornamental. Once established, the species can displace native plants forming dense aggregations that inhibit water flows which effects recreation, irrigation, and native plant growth. The climate match is high. Much of the contiguous United States has a climate that could support this species which is already present in many northern areas. The certainty of assessment is medium. The overall risk assessment category is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** *Butomus umbellatus* is present across much of the northern contiguous United States.
- **Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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10 References Quoted But Not Accessed

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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