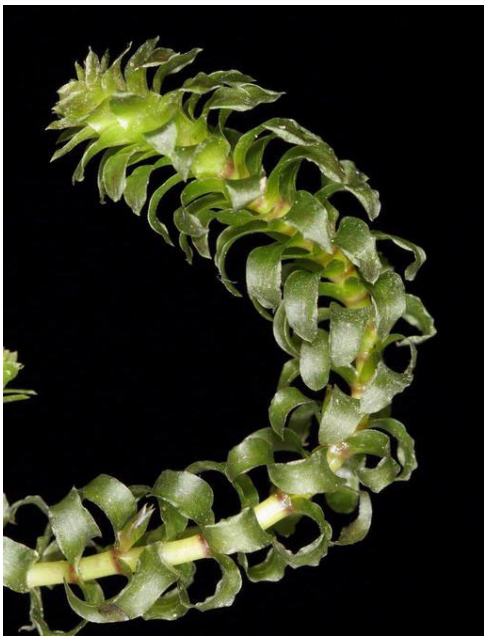
Canadian waterweed
Elodea canadensis Michx.

Synonyms: *Anacharis canadensis* (Michx.) Planch., *A. canadensis* var. *planchonii* (Caspary) Victorin, *Elodea brandegeeae* St. John, *E. ioensis* Wylie, *E. linearis* (Rydb.) St. John, *E. planchonii* Caspary, *Philotria canadensis* (Michx.) Britt., *P. linearis* Rydb.
Other common names: American elodea, American waterweed, anacharis, bassweed, broad waterweed, Canada waterweed, Canadian pondweed, Canadian water pest, common waterweed, ditch moss, elodea, oxygen weed, water-thyme, waterweed
Family: Hydrocharitaceae

Invasiveness Rank: **79** The invasiveness rank is calculated based on a species' ecological impacts, biological attributes, distribution, and response to control measures. The ranks are scaled from 0 to 100, with 0 representing a plant that poses no threat to native ecosystems and 100 representing a plant that poses a major threat to native ecosystems.

Note on taxonomy: Canadian waterweed has been known to forms fertile hybrids with Nuttall's waterweed (*Elodea nuttallii*) in natural environments (Cook and Urmi-Konig 1985). Laboratory crosses also yield fertile hybrids with viable seed (Ernst-Schwarzenbach 1945). Hybrids between these two species exhibit morphologically intermediate vegetative characteristics and are only distinguishable by their floral structures. Both species share geographic range and are native to most of temperate North America.

Description
Canadian waterweed is a perennial, freshwater, aquatic plant with submerged leaves and fibrous roots. Stems are branched at the nodes, slender, leafless near the base, and usually 20 to 100 cm long. Leaves are usually arranged in whorls of three but are occasionally opposite on the lower stem. Whorls are up to 2 cm apart on the lower stem but become crowded towards the upper stem. The ends of stems form densely crowded overwintering buds. Leaves are recurved, thin, broadly lanceolate to oblong, 5 to 17 mm long, and 1.75 to 5 mm wide with minutely toothed margins. Flowering plants are rare. Solitary flowers arise from leaf axils on long (3 to 20 cm), thread-like stalks. Male and female flowers are borne on different plants. Male flowers are longer and separate from the stems before or during flowering. Flowers consist of three sepals and three petals. Sepals are green, elliptic, 3.5 to 5 mm long and 2 to 2.5 mm wide in male flowers, and 2 to 3 mm long and 1 mm wide in female flowers. Petals are white, 3.5 to 5 mm long and 0.3 to 0.7 mm wide in male flowers, and 2.4 to 2.8 mm long and 1.3 to 1.7 mm wide in female flowers. Bracts on male flowers are 6 mm of greater. Capsules are narrowly ovoid, 5 to 6 mm long, and 2 to 3.2 mm wide with 5 to 6 mm long beaks (Spicer and Catling 1988, Haynes 2000, Klinkenberg 2010, Fairbanks Soil and Water Conservation District 2011).


Stem and foliage of *Elodea canadensis* Michx. Photo by R. Vidéki

Similar species: Canadian waterweed can be confused with several other non-native members of the Hydrocharitaceae family that are known or expected to occur in Alaska. Intraspecific hybrization between Canadian and Nuttall's waterweed can cause extensive variation within species; for this reason plants must be healthy and robust for accurate taxonomic determinations. Outside North America these species exhibit constant characteristics without variation and are more easily separated (Cook and Urmi-Konig 1985). Nuttall's waterweed (*Elodea nuttallii*) can be distinguished from Canadian waterweed by smaller bracts on the male flowers and smaller style on the female flowers; 4 mm or less and 2 mm or less respectively. The leaves of Nuttall's waterweed are smaller than Canadian waterweed, mostly less than 1.75 mm wide and lack bud-like shoots (Bowmer et al.

1995). Nuttall's waterweed seeds have short base hairs and lack the apical collar present on Canadian waterweed (Cook and Urmi-Konig 1985). Unlike Canadian waterweed, Brazilian waterweed (*Egeria densa*) has leaves that are arranged in whorls of five or more, and hydrilla (*Hydrilla verticillata*) has leaves that are arranged in groups of three to eight. Additionally, the leaves of hydrilla have much larger teeth along the margins and midveins on the lower leaf surfaces (Bowmer et al. 1995, Haynes 2000).

Dense infestation of *Elodea canadensis* Michx. in Chena Slough near Fairbanks, AK. Photo by Fairbanks Soil and Water Conservation District.

Ecological Impact

Impact on community composition, structure, and interactions: Canadian waterweed can form dense mats, especially on iron-rich substrates (Spicer and Catling 1988), displacing native plant species, decreasing planktonic productivity, and reducing local biodiversity (Rørslett 1986, Podraza 2010). However, populations are likely to decline as iron is removed from the substrate (Spicer and Catling 1988). This species reduces the amount of light available to surrounding vegetation, thereby reducing the density of or eliminating underlying layers (Rørslett 1986, Spicer and Catling 1988). In Chena Slough near Fairbanks, Alaska, it has formed dense monocultures, creating a new layer of tall aquatic vegetation (Larsen et al. 2010). Canadian waterweed provides a food source for many freshwater organisms, including aquatic insects and fish (Spicer and Catling 1988, Gollasch 2006). However, this species is expected to degrade natural fish habitat in Alaska (Fairbanks Soil and Water Conservation District 2011).

Impact on ecosystem processes: Canadian waterweed accumulates nutrients while reducing nutrient availability in the substrate. Dense populations can restrict water flow (Spicer and Catling 1988, Gollasch 2006). Infestations increase the turbidity and pH of water and cause significant variations in phosphorous concentrations. This species reduces oxygen concentrations within 5 cm of the substrate but increases oxygen concentrations above 5 cm (Spicer and Catling 1988).

Biology and Invasive Potential

Reproductive potential: Vegetative reproduction is the primary mode of establishment and spread for Canadian waterweed. This species reproduces vegetatively from stem fragments and condensed shoot buds that break away from the parent plants and root at the nodes. Plants produce vegetative buds at the beginning of winter or in unfavorable growing conditions. Single sex populations can invade waterways and spread aggressively. Although Canadian waterweed can reproduce sexually by seeds, few viable seeds are produced. Sexual reproduction is thus relatively unimportant (Spicer and Catling 1988, Bowmer et al. 1995). The amount of time seeds remain viable is unknown (Spicer and Catling 1988).

Role of disturbance in establishment: Floating plants can extend their roots through established vegetation into the substrate and outcompete surrounding vegetation for light (Spicer and Catling 1988).

Potential for long-distance dispersal: Seeds are transported by wind and water (Spicer and Catling 1988). Stem fragments and vegetative buds easily break away from the parent plants and float to new locations, where they root at the nodes. Stem fragments have higher survival rates in fall than in spring (Barrat-Segretain et al. 2002). Flooding significantly increased the density of propagules in a wetland soil bank along the Rhone River in France (Cellot et al. 1998). Stem fragments are dispersed by waterfowl (Spicer and Catling 1988). Vegetative buds can survive desiccation and low temperatures, and they can be dispersed by wildlife to new bodies of water (Bowmer et al. 1995).

Potential to be spread by human activity: Canadian waterweed is grown as an aquarium plant and has spread to new regions by trade. Many infestations, including those at Chena Slough, have likely originated from dumped aquarium material (Bowmer et al. 1995, Josefsson and Andersson 2001, Larsen et al. 2010). Stems can become tangled on and dispersed by boat props or trailers, vehicles that cross fords (Spicer and Catling 1988, Bowmer et al. 1995), and float plane rudders (Wurtz and Lisuzzo 2011).

Germination requirements: Information on the germination of seeds is not available. Meristem tissues are present in stem nodes and vegetative buds. Vegetative buds remain dormant on the bottom sediment over winter (Spicer and Catling 1988). Buds have relatively high starch contents. They do not require long periods of warm temperatures to elongate; buds can begin to grow after as few as three days at 18°C (Spicer and Catling 1988). Stem fragments containing at least four nodes were able to regenerate after storage in greenhouse water pans for more than ten weeks. Internodal stem fragments and root fragments do not

root or resprout (Barrat-Segretain et al. 1998).

Growth requirements: Canadian waterweed grows aggressively in static or slow moving waters and lakes and is able to survive cold climates (Bowmer et al. 1995, Fairbanks Soil and Water Conservation District 2011). It can grow slowly under ice cover and can overwinter in 1°C to 4°C water (Spicer and Catling 1988, Bowmer et al. 1995). Canadian waterweed can survive in a wide range of conditions but grows best on silts in mesotrophic waters with pH between 6.5 and 10. It usually grows in water 1 to 8 m deep but has been documented from water 12 m deep. The optimal water temperature range for growth is from 10°C to 25°C (Spicer and Catling 1988).

Congeneric weeds: Nuttall's waterweed (*Elodea nuttallii*) is known to occur as an invasive, non-native species in Europe (Barrat-Segretain et al. 2002).

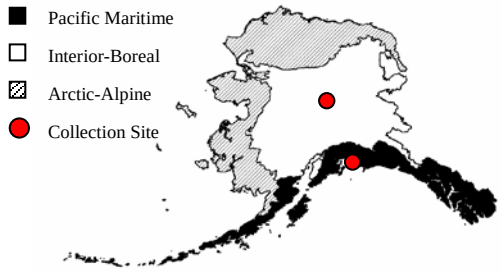
Legal Listings

- ☒ Has not been declared noxious
- ☐ Listed noxious in Alaska
- ☐ Listed noxious by other states
- ☐ Federal noxious weed
- ☐ Listed noxious in Canada or other countries

Distribution and Abundance

Canadian waterweed is grown deliberately as an aquarium plant (Bowmer et al. 1995). It grows in lakes, ponds, rivers, and streams (Haynes 2000, Klinkenberg 2010). It is often problematic in its native range in Canada, where populations reduce the navigability of waterways (Spicer and Catling 1988). This species causes major modifications in aquatic habitats in Sweden (Josefsson and Andersson 2001). It has spread around the entire perimeter of Lake Baikal in Russia, where it is highly competitive (Kozhova and Izhboldina 1992). In Lake Steinsfjord in Norway, it covered 79% of the lake bottom between 0 and 6 m depth (Rørslett et al. 1986), and it has created a new layer of dense aquatic vegetation in several rivers in New Zealand (Wells 2008).

Native and current distribution: Canadian waterweed is native to much of North America, including British Columbia (Haynes 2000). In British Columbia, it is frequent south of 51°N but rarely occurs farther north (Klinkenberg 2010). It grows in 46 states of the U.S. and much of southern Canada (Haynes 2000, USDA 2011). It has been introduced to Europe, Asia, Africa, Australia, and New Zealand (Spicer and Catling 1988, Bowmer et al. 1995, Thorp and Wilson 1998, Haynes 2000, Landcare Research 2011). This species is known to grow in subarctic Scandinavia (Gollasch 2006) and has been documented as far north as 65°N in Finland (University Museums of Alberta 2011). Canadian waterweed has been documented from Eyak Lake near Cordova in the Pacific Maritime ecogeographic region of Alaska and Fairbanks in the Interior-Boreal ecogeographic region (UAM 2011).



Distribution of Canadian waterweed in Alaska

Management

Mechanical control methods are often counterproductive because they cause stems to fragment, allowing the plants to spread to new areas (Bowmer et al. 1995). If populations are controlled mechanically, plants and plant parts must be removed from the water (Spicer and Catling 1988). Suctioning plants out with a pump may provide effective control while removing most plant materials (Wells 2008). Plants can be shaded with opaque, floating sheets (Podraza 2010). Most herbicides do not provide effective control of Canadian waterweed. However, fluridone can control populations in static water and acrolein can temporarily control populations in moving water. Paraquat and diquat can also be used to control Canadian waterweed, especially when applied in late spring or summer. However, the use of herbicides may not be suitable for natural areas, as they will also destroy native aquatic vegetation (Bowmer et al. 1995). Additionally, the large amounts of decaying vegetation will reduce available oxygen, possibly resulting in the eradication of other aquatic organisms. The introduction of the sterile triploid grass carp (*Ctenopharyngodon idella*) has proven effective in controlling populations of Canadian waterweed (Spicer and Catling 1988). Planting overhanging willows or other native trees and shrubs on the banks of waterways can outshade Canadian waterweed (Wells 2008).

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