

## Climate Change Vulnerability Index Report

### *Utricularia intermedia* (Flat-leaved bladderwort)

Date: 18 February 2021

Assessor: Walter Fertig, WA Natural Heritage Program

Geographic Area: Washington

Heritage Rank: G5/S2S3

Index Result: Moderately Vulnerable

Confidence: Very High

### Climate Change Vulnerability Index Scores

<b>Section A: Local Climate</b>	<b>Severity</b>	<b>Scope (% of range)</b>
1. Temperature Severity	>6.0° F (3.3°C) warmer	0
	5.6-6.0° F (3.2-3.3°C) warmer	0
	5.0-5.5° F (2.8-3.1°C) warmer	0
	4.5-5.0° F (2.5-2.7°C) warmer	0
	3.9-4.4° F (2.2-2.4°C) warmer	38.5
	<3.9° F (2.2°C) warmer	61.5
2. Hamon AET :PET moisture	< -0.119	0
	-0.097 to -0.119	7.7
	-0.074 to -0.096	84.6
	-0.051 to -0.073	7.7
	-0.028 to -0.050	0
	>-0.028	0
<b>Section B: Indirect Exposure to Climate Change</b>		<b>Effect on Vulnerability</b>
1. Sea level rise		Neutral
2a. Distribution relative to natural barriers		Somewhat Increase
2b. Distribution relative to anthropogenic barriers		Neutral/Somewhat Increase
3. Impacts from climate change mitigation		Neutral
<b>Section C: Sensitivity and Adaptive Capacity</b>		
1. Dispersal and movements		Neutral/Somewhat Increase
2ai Change in historical thermal niche		Increase/Greatly Increase
2aii. Change in physiological thermal niche		Somewhat Increase
2bi. Changes in historical hydrological niche		Neutral
2bii. Changes in physiological hydrological niche		Increase
2c. Dependence on specific disturbance regime		Neutral
2d. Dependence on ice or snow-covered habitats		Somewhat Increase
3. Restricted to uncommon landscape/geological features		Neutral
4a. Dependence on others species to generate required habitat		Neutral
4b. Dietary versatility		Not Applicable
4c. Pollinator versatility		Unknown
4d. Dependence on other species for propagule dispersal		Neutral
4e. Sensitivity to pathogens or natural enemies		Neutral
4f. Sensitivity to competition from native or non-native species		Somewhat Increase
4g. Forms part of an interspecific interaction not covered above		Neutral
5a. Measured genetic diversity		Unknown
5b. Genetic bottlenecks		Unknown
5c. Reproductive system		Neutral

6. Phenological response to changing seasonal and precipitation dynamics	Neutral
<b>Section D: Documented or Modeled Response</b>	
D1. Documented response to recent climate change	Neutral
D2. Modeled future (2050) change in population or range size	Unknown
D3. Overlap of modeled future (2050) range with current range	Unknown
D4. Occurrence of protected areas in modeled future (2050) distribution	Unknown

### Section A: Exposure to Local Climate Change

A1. Temperature: Eight of the 13 occurrences of *Utricularia intermedia* in Washington (61.5%) occur in areas with a projected temperature increase of <math><3.9^{\circ}\text{F}</math> (Figure 1). The other 5 occurrences (38.5%) are from areas with a projected temperature of 3.9-4.4 ° F.

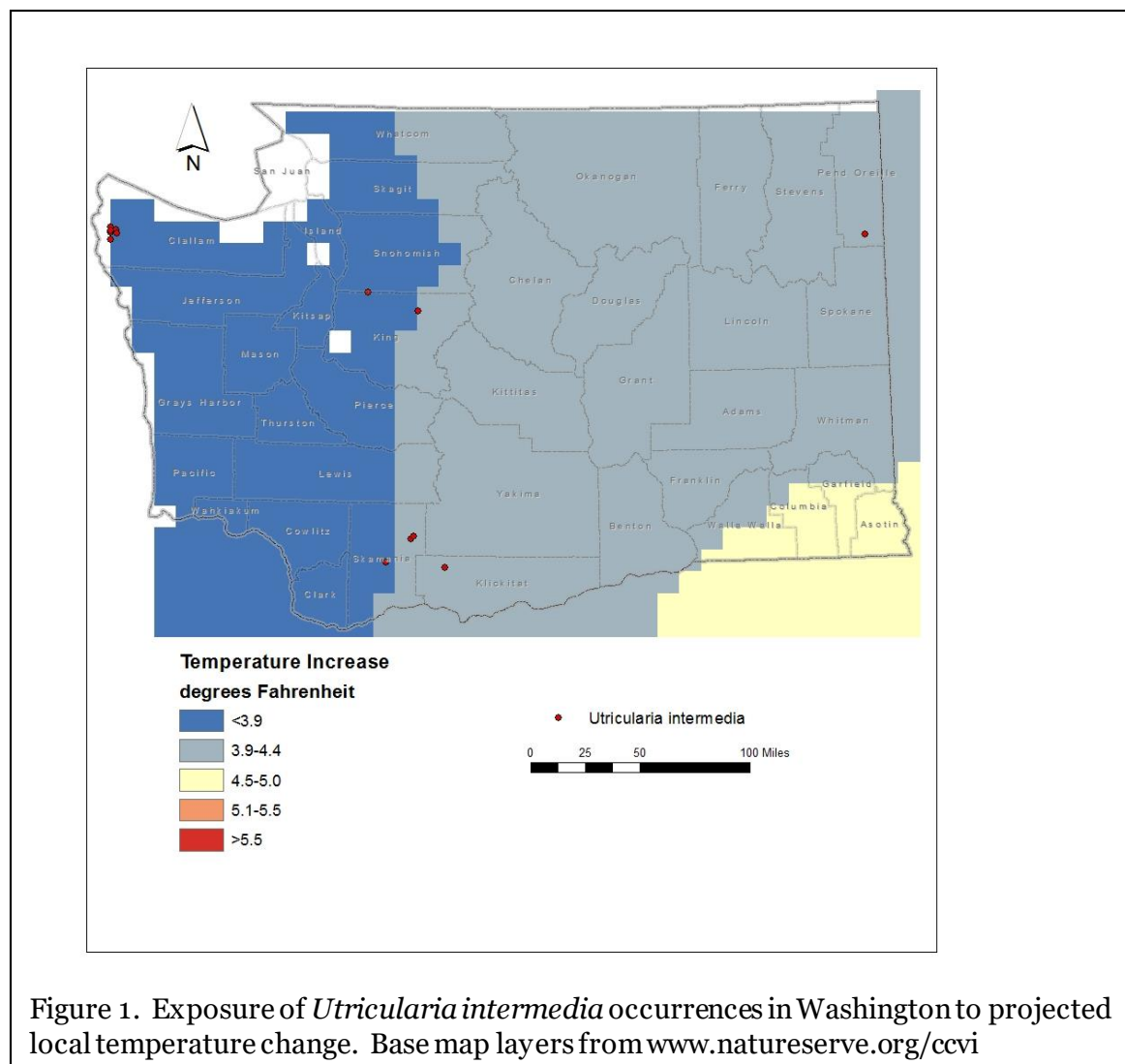


Figure 1. Exposure of *Utricularia intermedia* occurrences in Washington to projected local temperature change. Base map layers from [www.natureserve.org/ccvi](http://www.natureserve.org/ccvi)

A2. Hamon AET:PET Moisture Metric: Eleven of the 13 occurrences of *Utricularia intermedia* (84.6%) in western Washington are found in areas with a projected decrease in available moisture (as measured by the ratio of actual to potential evapotranspiration) in the range of -0.074 to -0.096 (Figure 2). One historical occurrence (7.7%) from Klickitat County is from an area with a projected decrease in moisture of -0.051 to -0.073. One other population from NE Washington (7.7%) is from an area with a projected decrease of -0.097 to -0.119.

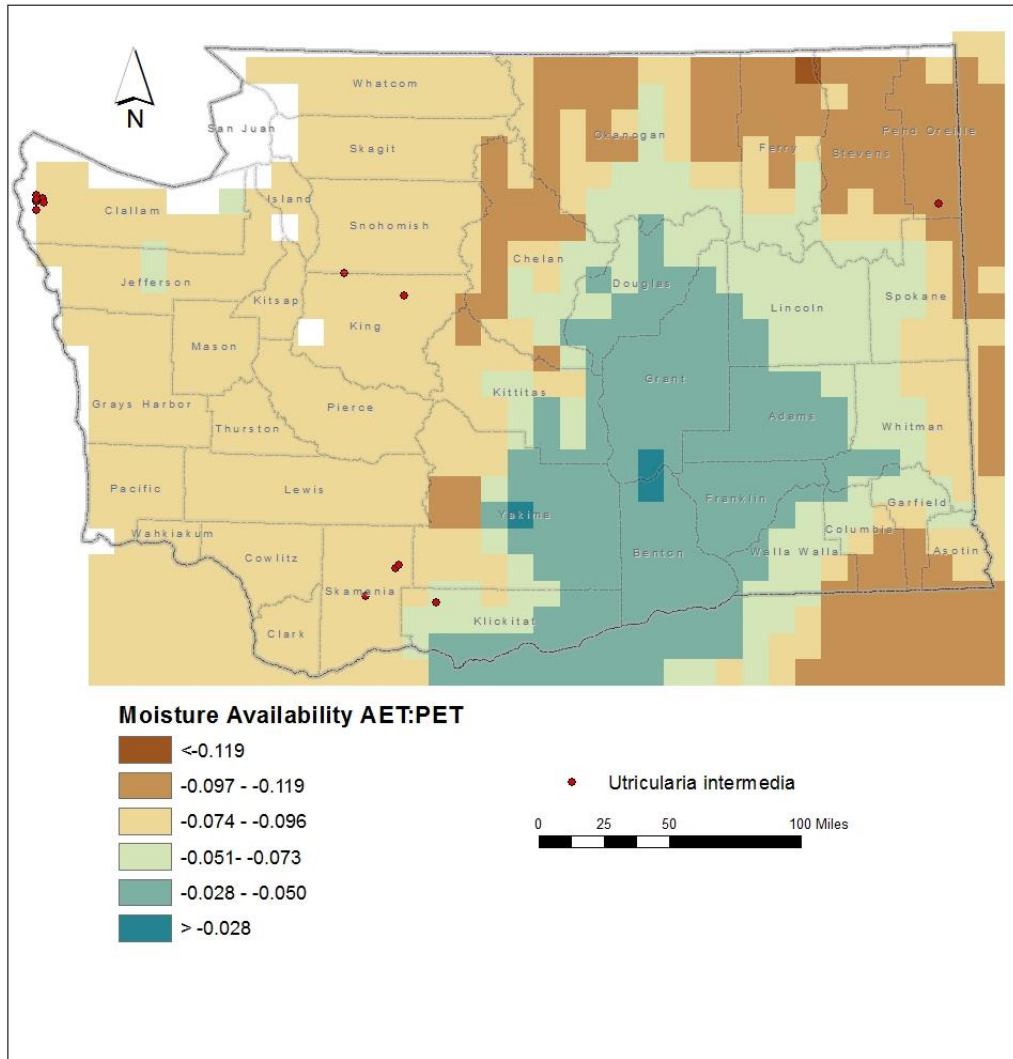


Figure 2. Exposure of *Utricularia intermedia* occurrences in Washington to projected moisture availability (based on ratio of actual to predicted evapotranspiration). Base map layers from [www.natureserve.org/ccvi](http://www.natureserve.org/ccvi)

## **Section B. Indirect Exposure to Climate Change**

B1. Exposure to sea level rise: Neutral.

Washington occurrences of *Utricularia intermedia* are found at 10-4100 feet (3-1300 m) and would not be inundated by projected sea level rise. At least six occurrences are found along the shores of Lake Ozette (elevation 10 feet) on the Olympic Peninsula, 1.3-4 miles east of the Pacific Ocean. These populations could be vulnerable to storm surges or severe weather related to climate change.

B2a. Natural barriers: Somewhat Increase.

In Washington, *Utricularia intermedia* is an emergent aquatic species found in shallow ponds, lakeshores, fens, and flooded marshes (Camp and Gamon 2011, Fertig & Kleinknecht 2020). These habitats are a component of the North American Arid West Emergent Marsh, Rocky Mountain Subalpine-Montane Fen, and Temperate Pacific Freshwater Aquatic Bed ecological systems (Rocchio and Crawford 2015). Individual populations are separated by 3-332 km (2-205 miles). Most of the matrix vegetation between occurrences is unsuitable and presents a barrier to dispersal.

B2b. Anthropogenic barriers: Neutral/Somewhat Increase.

The range of *Utricularia intermedia* in Washington is associated with small ponds, lakes, fens and marshes. Populations are widely scattered and isolated, largely due to natural barriers. The human footprint from roads and commercial or agricultural development, has also fragmented the landscape and is an impediment to dispersal, though probably of lesser significance than natural factors.

B3. Predicted impacts of land use changes from climate change mitigation: Neutral.

## **Section C: Sensitive and Adaptive Capacity**

C1. Dispersal and movements: Neutral/Somewhat Increase.

Like other aquatic species of *Utricularia*, *U. intermedia* produces numerous, small seeds within dry fruiting capsules. These seeds lack ornamentation, such as spines, or hooks to attach to animals. Seed could be transported long distances in mud on the feet of waterfowl. In lakes or ponds, seeds could also be distributed by water (Neid 2006). This species also produces asexual, bud-like, vegetative structures called turions that can be transported by water or aquatic birds in the same manner as seeds (Adamec 2020). Most dispersal is probably within less than 1000 m of the parent plant, but birds could transport some seeds or turions over many kilometers, accounting for the patchy and disjunct range of *U. intermedia* in the state.

C2ai. Historical thermal niche: Increase/Greatly Increase.

Figure 3 depicts the distribution of *Utricularia intermedia* in Washington relative to mean seasonal temperature variation for the period from 1951-2006 (“historical thermal niche”). Six of the 13 known occurrences (46.1%) from Washington are found in areas that have experienced very small (<37°F/20.8°C) temperature variation during the past 50 years and are considered at greatly increased risk from climate change (Young et al. 2016). Five occurrences from the Cascade Range (38.5%) are from areas with small temperature variation (37-47°F/20.8-26.3°C) over the same period and are at increased vulnerability. One historical occurrence from

Klickitat County (7.7%) has experienced slightly lower than average temperature variation (47.1-57 °F/26.3-31.8 °C) and has somewhat increased vulnerability. One occurrence from northeast Washington (7.7%) has had average (57.1-77 °F/31.8-43.0 °C) temperature variation over the last 50 years and is at neutral risk from climate change (Young et al. 2016).

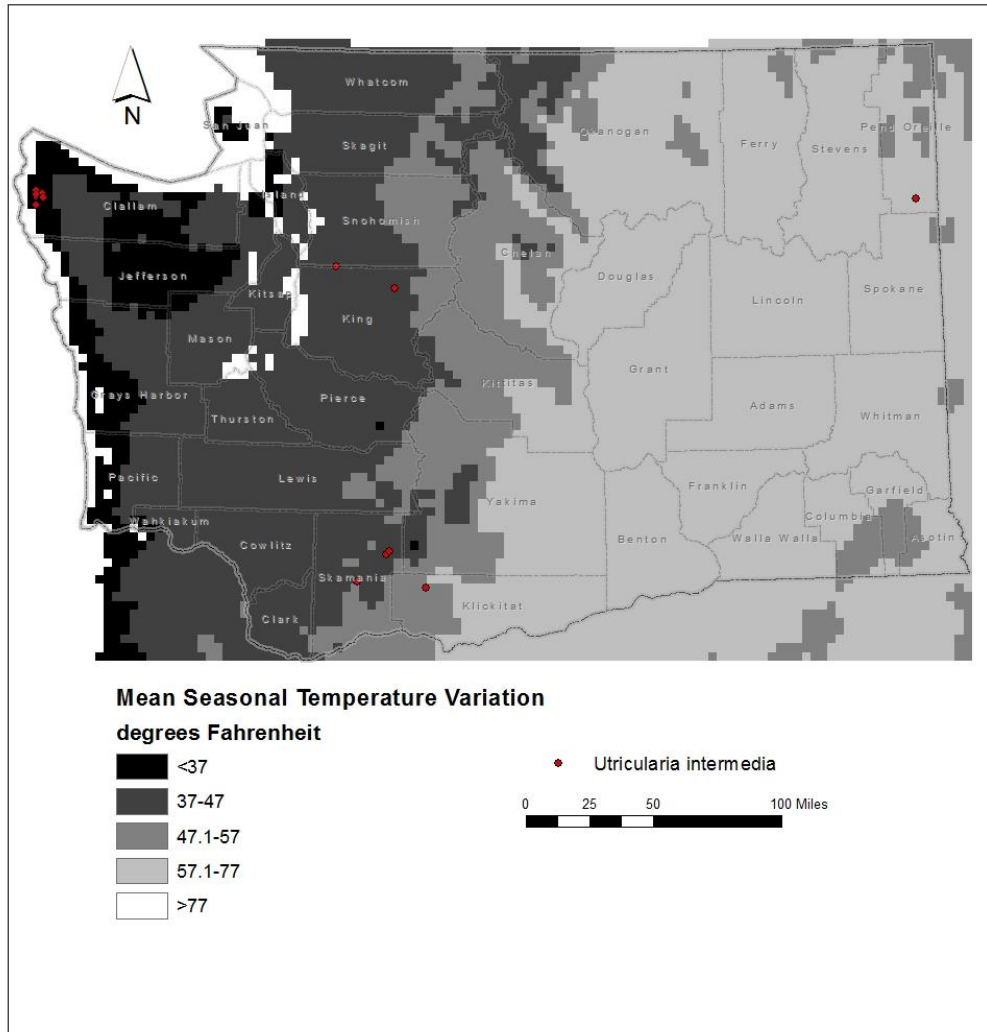


Figure 3. Historical thermal niche (exposure to past temperature variations) of *Utricularia intermedia* occurrences in Washington. Base map layers from [www.natureserve.org/ccvi](http://www.natureserve.org/ccvi)

C2a.ii. Physiological thermal niche: Somewhat Increase.

The pond, lake, fen, and marsh sites occupied by *Utricularia intermedia* are often associated with cool, shaded conditions or cold air drainage during the growing season and would have somewhat increased vulnerability to climate change.

C2bi. Historical hydrological niche: Neutral.

Eleven of the 13 occurrences of *Utricularia intermedia* in Washington (84.6%) are found in areas that have experienced greater than average precipitation variation (>40 inches/1016 mm) in the past 50 years (Figure 4). Two other populations (15.4%) are from areas with average (21-40 inches/508-1016 mm) precipitation variation in the same period. According to Young et al. (2016), all of these areas in Washington are at neutral vulnerability to climate change.

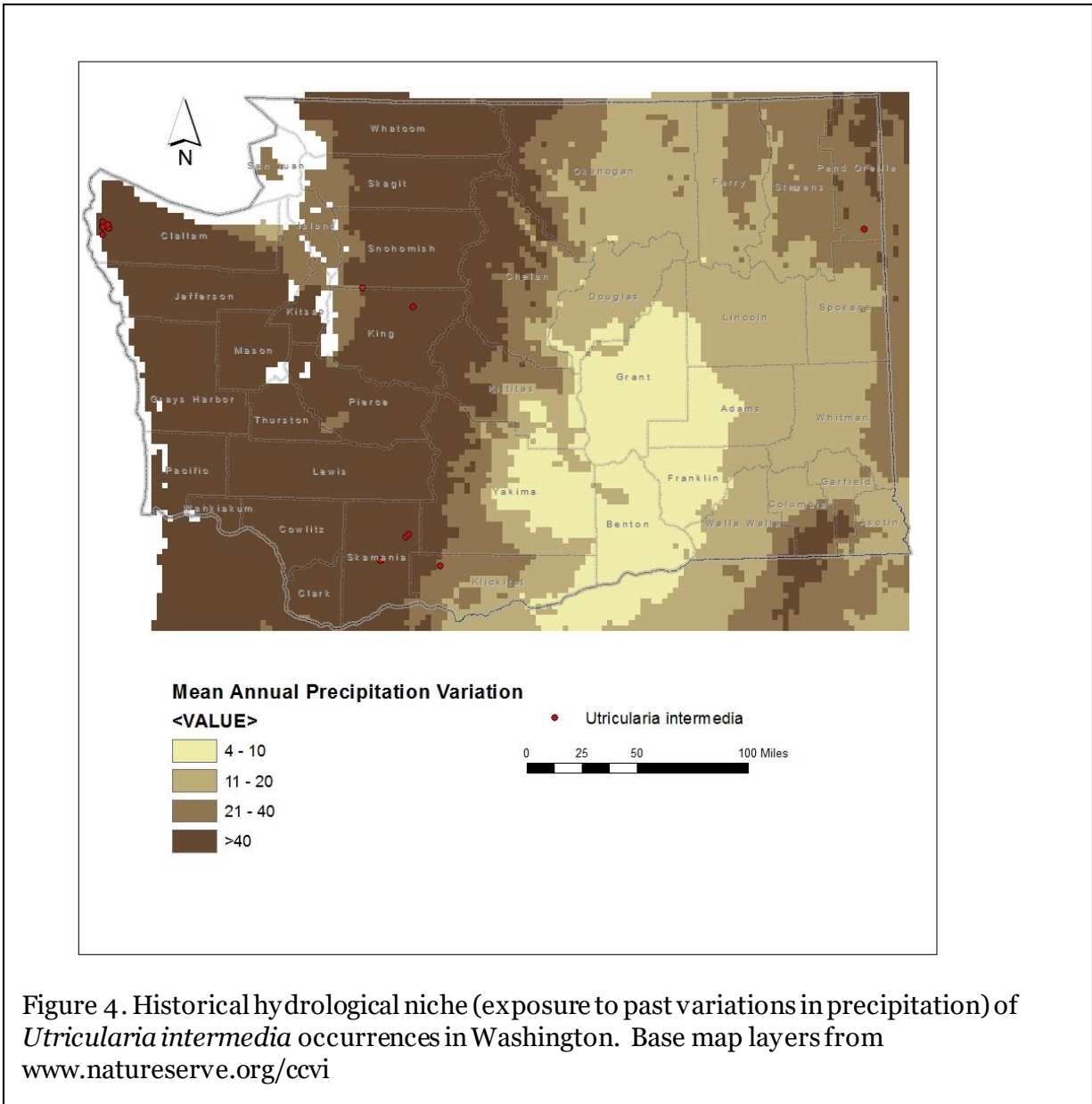


Figure 4. Historical hydrological niche (exposure to past variations in precipitation) of *Utricularia intermedia* occurrences in Washington. Base map layers from [www.natureserve.org/cvi](http://www.natureserve.org/cvi)

C2bii. Physiological hydrological niche: Increase.

Populations of *Utricularia intermedia* from western Washington associated with lakeshores in the Temperate Pacific Freshwater Aquatic Bed ecological system are vulnerable to changes in water depth resulting from either increased spring flooding from early snowmelt or enhanced

drawdown from changes in the timing or amount of precipitation. These sites could also be adversely affected by increases in water temperature (Rocchio and Ramm-Granberg 2017). Occurrences from eastern Washington in the North American Arid West Emergent Marsh ecological system are at risk from increased temperatures and reduced precipitation or snowpack leading to prolonged drought and potential shifts in vegetation from marsh to wet meadow (Rocchio and Ramm-Granberg 2017). The occurrence from northeastern Washington from the Rocky Mountain Subalpine-Montane Fen ecological system could be negatively affected by changes in the timing or amount of precipitation or winter snow, increased drought, and conversion of habitat to drier vegetation (Rocchio and Ramm-Granberg 2017).

C2c. Dependence on a specific disturbance regime: Neutral.

*Utricularia intermedia* is not dependent on periodic disturbances to maintain its pond, lake, marsh, and fen habitat.

C2d. Dependence on ice or snow-cover habitats: Somewhat Increase.

With the exception of occurrences found along Lake Ozette, the occurrences of *Utricularia intermedia* in Washington occur in areas of moderate to high snowfall. A reduction in overall snowpack or change in the timing of snowmelt would make wetland populations dependent on groundwater recharge more vulnerable to future climate change (Rocchio and Ramm-Granberg 2017).

C3. Restricted to uncommon landscape/geological features: Neutral.

*Utricularia intermedia* is found in small ponds, lakes, marshes, and fens in the Olympic Peninsula, Cascades, and Canadian Rockies in northeast Washington. Populations in the Olympics and northern Cascades are found primarily on Quaternary alluvium or lacustrine deposits associated with glacial activity. Occurrences from the southern Cascades east of Mount Adams are associated with Quaternary volcanic flows. The single fen occurrence in northeast Washington is found on peat over Missoula Lake flood deposits (Washington Division of Geology and Earth Resources 2016). Except for the fen site, the other geologic settings where *U. intermedia* occur are widespread in the state.

C4a. Dependence on other species to generate required habitat: Neutral.

The habitat occupied by *Utricularia intermedia* is maintained primarily by natural abiotic processes rather than by interactions with other species.

C4b. Dietary versatility: Not applicable for plants

C4c. Pollinator versatility: Unknown.

*Utricularia intermedia* has showy flowers with nectar rewards adapted for insect pollination by flies or bees (Adamec 2020). The exact pollinators in Washington are not known,

C4d. Dependence on other species for propagule dispersal: Neutral.

Seeds and turions of *Utricularia* species may be dispersed by water within ponds and lakes, or more widely on mud-encrusted birds or mammals (Neid 2006). Dispersal is not limited to a particular animal species.

C4e. Sensitivity to pathogens or natural enemies: Neutral.  
Impacts from pathogens are not known. Grazing is not considered a significant threat (Fertig and Kleinknecht 2020).

C4f. Sensitivity to competition from native or non-native species: Somewhat Increase.  
Wetland sites inhabited by *Utricularia intermedia* are vulnerable to competition from reed canarygrass (*Phalaris arundinacea*) (Fertig and Kleinknecht 2020).

C4g. Forms part of an interspecific interaction not covered above: Neutral.  
*Utricularia intermedia* is a carnivorous plant that supplements its photosynthetic production of sugars with capturing and dissolving minute aquatic invertebrates in specialized bladders dispersed among its leaves. The number of potential invertebrate species available as food sources, however, is not limiting.

C5a. Measured genetic variation: Unknown.  
Genetic data are not available for Washington occurrences of *Utricularia intermedia*. Studies in Europe have found the genome size of *Utricularia* species to be unusually small relative to other vascular plants (Adamec 2020). Based on genetic data, pollen fertility, and seed viability, *U. intermedia* is thought to be one of the parental taxa of *U. ochroleuca*.

C5b. Genetic bottlenecks: Unknown.

C5c. Reproductive System: Neutral.  
*Utricularia intermedia* produces large, showy flowers that provide a nectar reward for pollinators in a tube-like spur at the back of the corolla. The combination of floral traits and production of fertile pollen strongly suggests this species is primarily insect pollinated (Beretta et al. 2014). This species is presumed to have average genetic diversity based on its outcrossing reproductive strategy.

C6. Phenological response to changing seasonal and precipitation dynamics: Neutral.  
Based on flowering dates from specimens in the Consortium of Pacific Northwest herbaria website, no major changes have been detected in phenology in recent years.

## **Section D: Documented or Modeled Response to Climate Change**

D1. Documented response to recent climate change: Neutral.  
Two of the 13 known occurrences of *Utricularia intermedia* are historical and have not been relocated since 1981. Overall, the range of the species in Washington has not changed notably in the last 50 years.

D2. Modeled future (2050) change in population or range size: Unknown

D3. Overlap of modeled future (2050) range with current range: Unknown

D4. Occurrence of protected areas in modeled future (2050) distribution: Unknown



## References

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