Climate Change Vulnerability Index Report

Cryptantha spiculifera (Snake River cryptantha)

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Assessor: Walter Fertig, WA Natural Heritage Program

Geographic Area: Washington | Heritage Rank: G4?/S2S3

Index Result: Moderately Vulnerable | Confidence: Very High

Climate Change Vulnerability Index Scores

Section A	**Severity**	**Scope (% of range)**
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	100
	<3.9° F (2.2°C) warmer	0
2. Hamon AET:PET moisture	< -0.119	0
	-0.097 to -0.119	0
	-0.074 to - 0.096	3.5
	-0.051 to - 0.073	24.1
	-0.028 to -0.050	72.4
	>-0.028	0
Section B		**Effect on Vulnerability**
1. Sea level rise		Neutral
2a. Distribution relative to natural barriers		Neutral
2b. Distribution relative to anthropogenic barriers		Somewhat Increase
3. Impacts from climate change mitigation		Neutral
Section C		
1. Dispersal and movements		Somewhat Increase
2ai Change in historical thermal niche		Neutral
2aii. Change in physiological thermal niche		Neutral
2bi. Changes in historical hydrological niche		Somewhat Increase
2bii. Changes in physiological hydrological niche		Increase
2c. Dependence on specific disturbance regime		Neutral
2d. Dependence on ice or snow-covered habitats		Neutral
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		Neutral
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	Somewhat Increase
Section D	
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: all 29 of the known occurrences of *Cryptantha spiculifera* in Washington (100%) occur in an area with a projected temperature increase of 3.9-4.4˚ F (Figure 1).

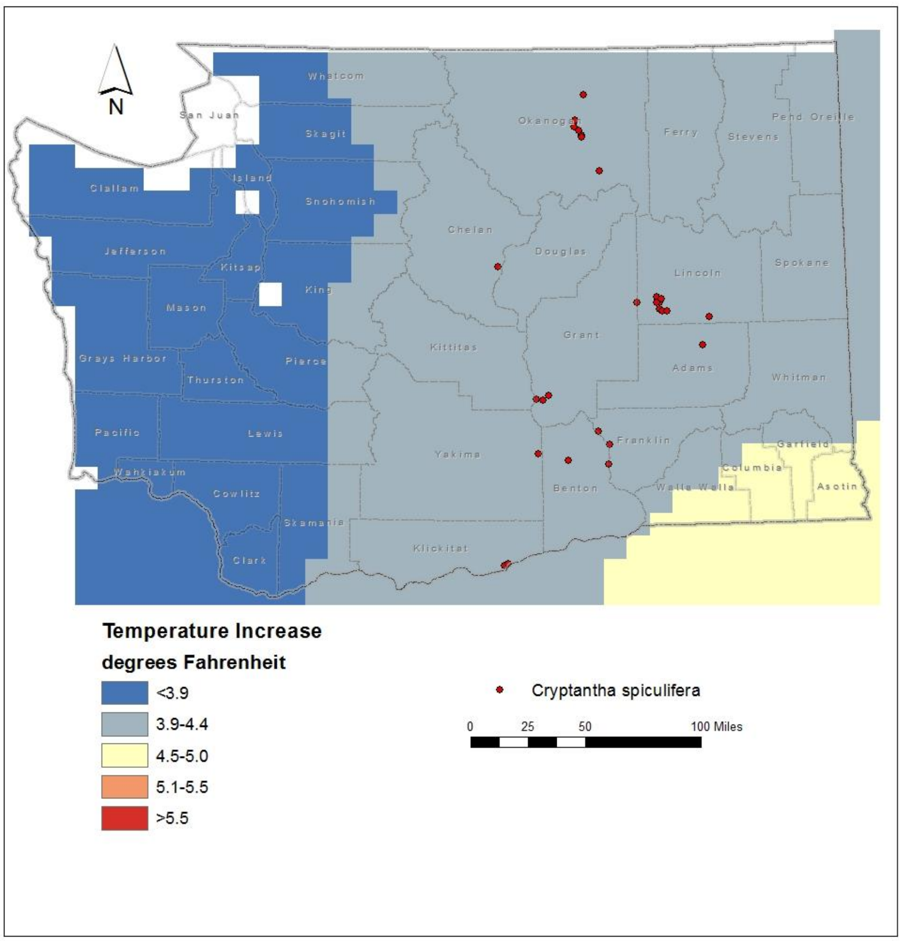

Figure 1. Exposure of *Cryptantha spiculifera* occurrences in Washington to projected local temperature change. Base map layers from www.natureserve.org/ccvi

A2. Hamon AET:PET Moisture Metric: Twenty-one of 29 occurrences of *Cryptantha spiculifera* (72.4%) in 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 -0.028 to -0.050 (Figure 2). Seven of 29 populations (24.1%) occur in areas with a projected decrease in available moisture of -0.051 to -0.073. One population (3.5%) has a projected decrease of -0.074 to -0.096 (Figure 2).

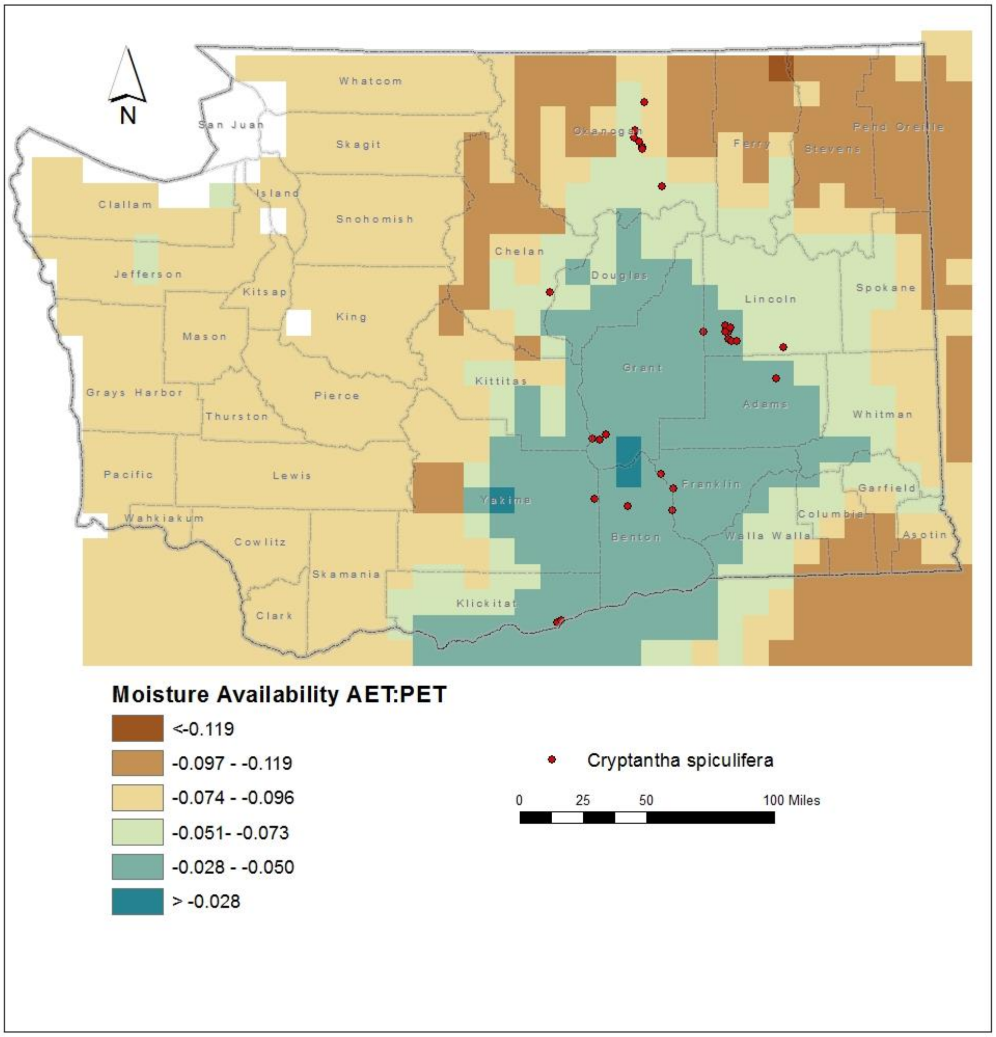

Figure 2. Exposure of *Cryptantha spiculifera* occurrences in Washington to projected moisture availability (based on ratio of actual to predicted evapotranspiration). Base map layers from www.natureserve.org/ccvi

Section B. Indirect Exposure to Climate Change

B1. Exposure to sea level rise: Neutral.
Washington occurrences of *Cryptantha spiculifera* are found at 450-3500 feet (140-1050 m) and would not be inundated by projected sea level rise.

B2a. Natural barriers: Neutral
In Washington, *Cryptantha spiculifera* is found in sparsely vegetated openings within desert grasslands and *Artemisia tridentata, A. rigida*, or *Salvia dorrii*-dominated shrub steppe on steep, unstable slopes or barren ridgecrests on basalt, alluvium, gravel, or white calcium carbonate caliche (Camp and Gamon 2011, Fertig and Kleinknecht 2020). This habitat is a component of the Inter-Mountain Basins Cliff and Canyon and the Inter-Mountain Basin Semi-Desert Shrub-Steppe ecological systems (Rocchio and Crawford 2015). Populations are separated by 0.5-60 miles (0.7-98 km) and are scattered within a matrix of sagebrush steppe, desert shrub, or grassland communities overlain by extensive areas of human development (roads, towns, and agricultural development). Anthropogenic barriers probably create more of an impediment to dispersal than natural barriers.

B2b. Anthropogenic barriers: Somewhat Increase.
The range of *Cryptantha spiculifera* is bisected by human development, including roads, towns, and agricultural fields. These probably present more of an obstacle to dispersal than natural barriers.

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

Section C: Sensitive and Adaptive Capacity

C1. Dispersal and movements: Somewhat Increase.
At maturity, *Cryptantha spiculifera* fruits split into 1 to 4 nutlets. The outer wall of each nutlet has low ridges and small tubercles that could help the fruit segments attach to small animals for dispersal. Nutlets are small enough to also be dispersed by strong winds or gravity. Average dispersal distances are probably less than 1 km.

C2ai. Historical thermal niche: Neutral.
Figure 3 depicts the distribution of *Cryptantha spiculifera* in Washington relative to mean seasonal temperature variation for the period from 1951-2006 ("historical thermal niche"). All 29 of the known occurrences (100%) are found in areas that have experienced average (57.1-77˚F/31.8-43.0˚C) temperature variation during the past 50 years and are considered at neutral vulnerability to climate change.

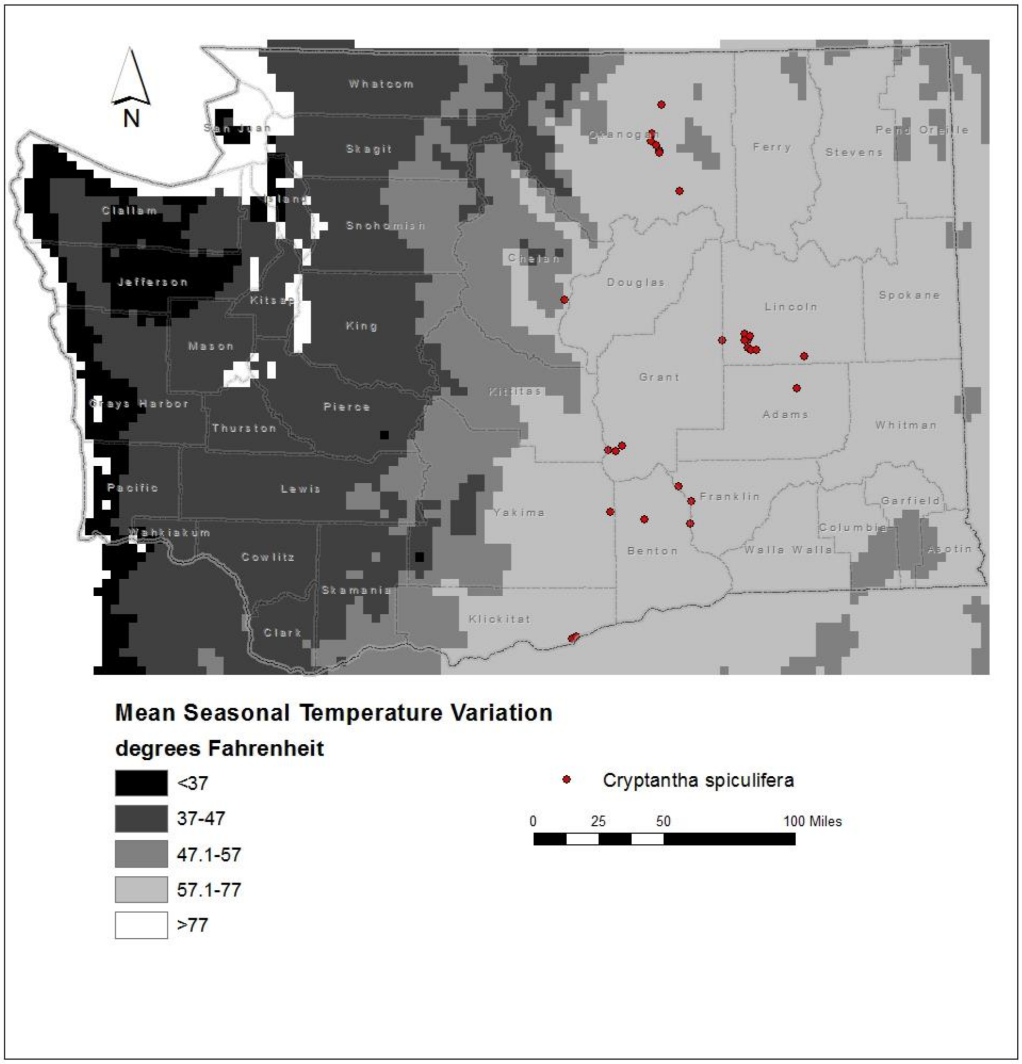

Figure 3. Historical thermal niche (exposure to past temperature variations) of *Cryptantha spiculifera* occurrences in Washington. Base map layers from www.natureserve.org/ccvi

C2aii. Physiological thermal niche: Neutral.
The barren ridge and rocky slope habitat of *Cryptantha spiculifera* in the Columbia Plateau is not associated with cold air drainage during the growing season and would have neutral vulnerability to climate change.

C2bi. Historical hydrological niche: Somewhat Increase.
Nineteen of the 29 occurrences of *Cryptantha spiculifera* in Washington (65.5%) are found in areas that have experienced slightly lower than average (11-20 inches/255-508 mm) of precipitation variation in the past 50 years (Figure 4). According to Young et al. (2016), these occurrences are at somewhat increased vulnerability to climate change. The remaining 10 occurrences (34.5%) are from areas that have experienced small (4-10 inches/100-254 mm) of precipitation variation over the same period and are considered to be at increased vulnerability to climate change.

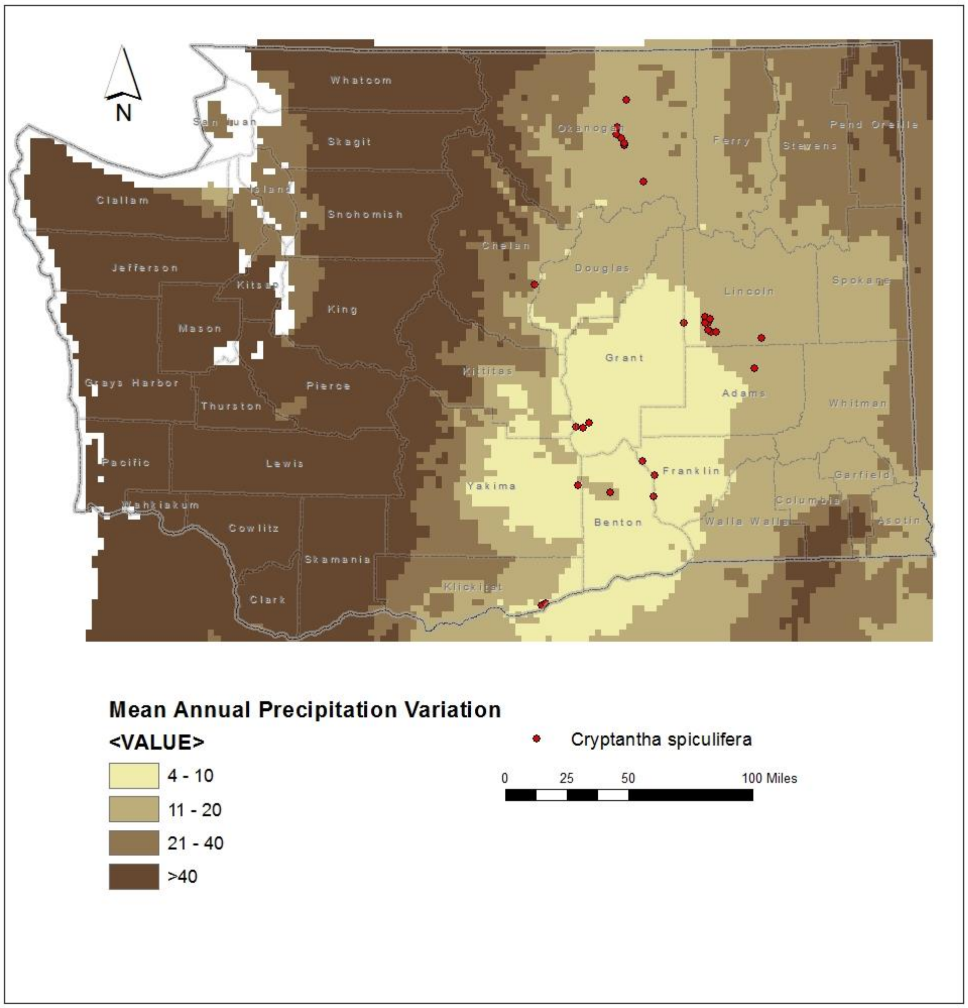

Figure 4. Historical hydrological niche (exposure to past variations in precipitation) of *Cryptantha spiculifera* occurrences in Washington. Base map layers from www.natureserve.org/ccvi

C2bii. Physiological hydrological niche: Increase.

This species is dependent on precipitation and winter snow for its moisture requirements, because its habitat is not associated with springs, streams, or groundwater. The Inter-Mountain Basins Cliff and Canyon and Inter-Mountain Basin Semi-Desert Shrub-Steppe ecological systems are vulnerable to changes in the timing or amount of precipitation and increases in temperature, with resulting increases in fire frequency (Rocchio and Ramm-Granberg 2017).

C2c. Dependence on a specific disturbance regime: Neutral.
Cryptantha spiculifera is not dependent on periodic disturbances to maintain its barren shrub steppe habitat. The species could, however, be detrimentally affected by increased summer temperatures, drought, or decreased precipitation that would increase fire frequency and convert its habitat to annual grasslands dominated by introduced species (Rocchio and Ramm-Granberg 2017).

C2d. Dependence on ice or snow-cover habitats: Neutral.
Snowpack is relatively low over most of the range of *Cryptantha spiculifera* in the Columbia Plateau of eastern Washington area and probably a minor component of its annual water budget.

C3. Restricted to uncommon landscape/geological features: Neutral.
Cryptantha spiculifera occurs primarily on barren ridgecrests or steep slopes of loose rock. It can grow on a variety of geologic substrates, including basalt lithosols, alluvium, gravel, sand, and calcium-carbonate caliche. Most of these rock types occur widely in the Columbia Plateau ecoregion.

C4a. Dependence on other species to generate required habitat: Neutral
The barren ridgetop and slope habitat occupied by *Cryptantha spiculifera* is maintained by natural abiotic processes and geologic conditions, rather than by interactions with other species.

C4b. Dietary versatility: Not applicable for plants

C4c. Pollinator versatility: Neutral.
Cryptantha species are pollinated by bees, flies, and other insects and tend not to show high specificity.

C4d. Dependence on other species for propagule dispersal: Neutral.
The nutlets of *Cryptantha spiculifera* are probably dispersed passively by gravity or transported short distances by animals (which may be seed or fruit predators).

C4e. Sensitivity to pathogens or natural enemies: Neutral.
Impacts from pathogens are not known. Herbivory has not been identified as a significant threat (Fertig and Kleinknecht 2020).

C4f. Sensitivity to competition from native or non-native species: Neutral.
Cryptantha spiculifera occurs in sparsely vegetated outcrops that currently have relatively low cover and competition from other species. Climate change could shift the composition to more annual plant species (Rocchio and Ramm-Granberg 2017), including some that could be invasive exotics.

C4g. Forms part of an interspecific interaction not covered above: Neutral.
Does not require an interspecific interaction.

C5a. Measured genetic variation: Unknown.
No genetic data are available for *Cryptantha spiculifera* in Washington.

C5b. Genetic bottlenecks: Unknown.

C5c. Reproductive System: Neutral
Cryptantha spiculifera is presumed to be an outcrosser, rather than self-pollinated. Presumably, genetic variation is average, compared to other species, but no studies have been done on this species for confirmation.

C6. Phenological response to changing seasonal and precipitation dynamics: Somewhat Increase.
Based on herbarium records from the Consortium of Pacific Northwest herbaria website, *Cryptantha spiculifera* populations in Washington have been blooming from the last week of April to early June since at least the 1980s. Historical collections from 1893-1979 are from early May to early June.

Section D: Documented or Modeled Response to Climate Change

D1. Documented response to recent climate change: Neutral.
Although three occurrences of this species are historical in Washington, significant changes in the distribution of *Cryptantha spiculifera* have not been documented.

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

Camp, P. and J.G. Gamon, eds. 2011. Field Guide to the Rare Plants of Washington. University of Washington Press, Seattle. 392 pp.

Fertig, W. and J. Kleinknecht. 2020. Conservation status and protection needs of priority plant species in the Columbia Plateau and East Cascades ecoregions. Natural Heritage Report 2020-02. Washington Natural Heritage Program, Department of Natural Resources, Olympia, WA. 173 pp.

Rocchio, F.J. and R.C. Crawford. 2015. Ecological systems of Washington State. A guide to identification. Natural Heritage Report 2015-04. Washington Natural Heritage Program, WA Department of Natural Resources, Olympia, WA. 384 pp.

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