Climate Change Vulnerability Index Report

Erigeron salishii (Salish fleabane)

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Assessor: Walter Fertig, WA Natural Heritage Program

Geographic Area: Washington Heritage Rank: G3/S2

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	50
	-0.074 to - 0.096	50
	-0.051 to - 0.073	0
	-0.028 to -0.050	0
	>-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		Neutral
3. Impacts from climate change mitigation		Neutral
Section C		
1. Dispersal and movements		Neutral
2ai Change in historical thermal niche		Somewhat Increase
2aii. Change in physiological thermal niche		Greatly Increase
2bi. Changes in historical hydrological niche		Neutral
2bii. Changes in physiological hydrological niche		Neutral
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		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	Neutral
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 12 of the extant and historical occurrences of *Erigeron salishii* in Washington occur in areas with a projected temperature increase of 3.9-4.4˚ F (Figure 1).

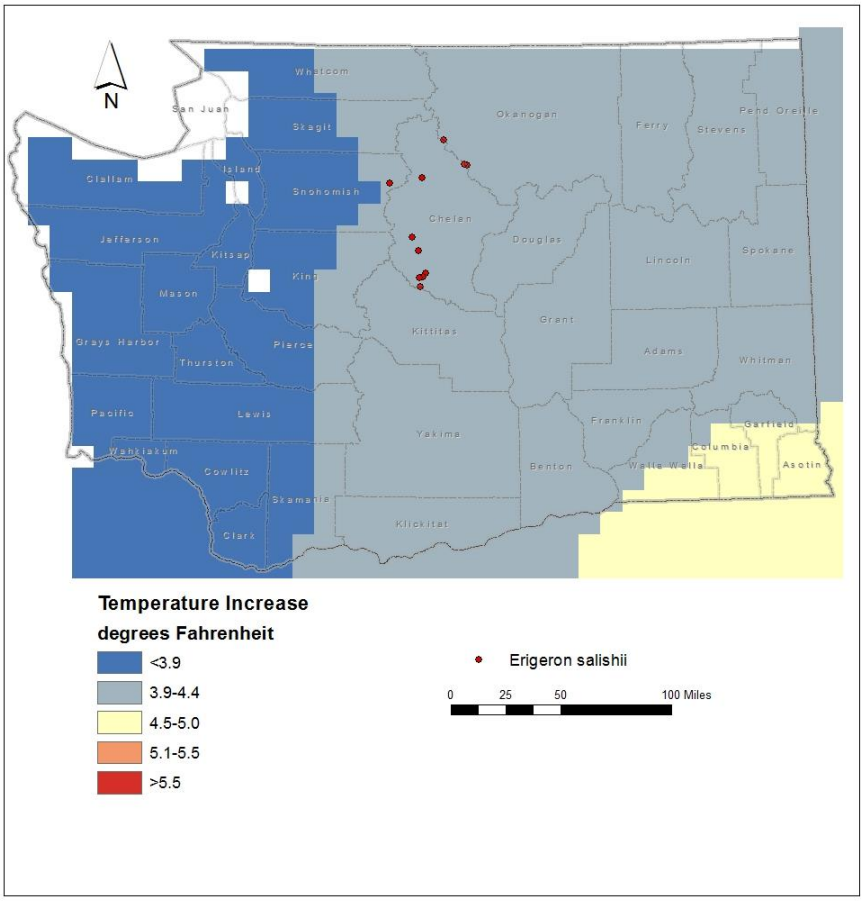

Figure 1. Exposure of *Erigeron salishii* occurrences in Washington to projected local temperature change. Base map layers from www.natureserve.org/ccvi

A2. Hamon AET:PET Moisture Metric: Six of the 12 occurrences (50%) of *Erigeron salishii* 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 -0.097 to -0.119 (Figure 2). The other fifty percent of occurrences are in areas with projected decrease of -0.074 to -0.096.

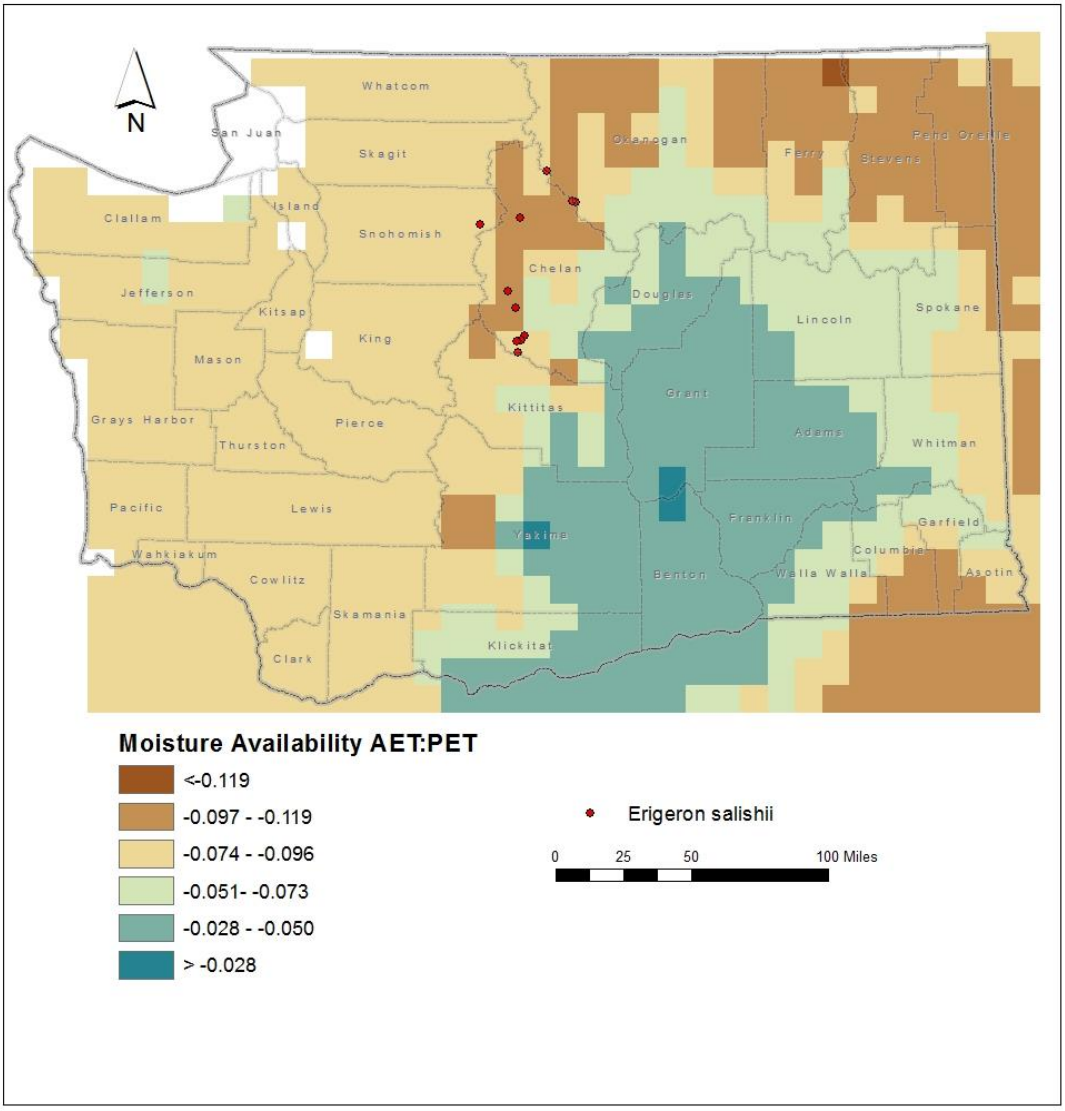

Figure 2. Exposure of *Erigeron salishii* occurrences in Washington to projected moisture availability (based on ratio of actual to predicted evapotranspiration). Base map layers from www.natureserve.org/ccvi

Section B. Indirect Exposure to Climate Change

B1. Exposure to sea level rise: Neutral.
Washington occurrences of *Erigeron salishii* are found at 6600-9000 feet (2000-2800 m) and would not be inundated by projected sea level rise.

B2a. Natural barriers: Neutral.
Erigeron salishii occurs primarily on dry, rocky talus slopes or ridgetops with granite, sand, or loess soils in the alpine zone (Camp and Gamon 2011). This habitat is part of the Rocky Mountain Alpine Bedrock and Scree ecological system (Rocchio and Crawford 2015). Populations may be isolated from each other by 1.2-25 miles (2-40 km) of unoccupied and unsuitable habitat, although this distance is not a complete barrier to propagule dispersal.

B2b. Anthropogenic barriers: Neutral.
The alpine habitat of *Erigeron salishii* in Washington is located primarily along the crest of the East and North Cascades and is relatively unimpacted by human development and barriers.

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

Section C: Sensitive and Adaptive Capacity

C1. Dispersal and movements: Neutral.
Erigeron salishii produces numerous, small achenes with a feathery pappus that are adapted for dispersal by the wind. Dispersal distances may vary, but the species has the potential for moderate to long-distance dispersal (over 1 km).

C2ai. Historical thermal niche: Somewhat Increase.
Figure 3 depicts the distribution of *Erigeron salishii* in Washington relative to mean seasonal temperature variation for the period from 1951-2006 ("historical thermal niche"). Nine of the 12 known occurrences in the state (75%) are found in areas that have experienced slightly lower than average (47.1-57˚F/26.3-31.8˚C) temperature variation during the past 50 years and are considered at somewhat increased vulnerability to climate change (Young et al. 2016). The three other occurrences (25%) are from areas that have had a small variation (37-47˚F/20.8-26.3˚C) in temperature over the same period and are at increased vulnerability to climate change.

C2aii. Physiological thermal niche: Greatly Increase.
The alpine talus and tundra habitat of *Erigeron salishii* is entirely within a cold climate zone during the flowering season and highly vulnerable to temperature increase from climate change.

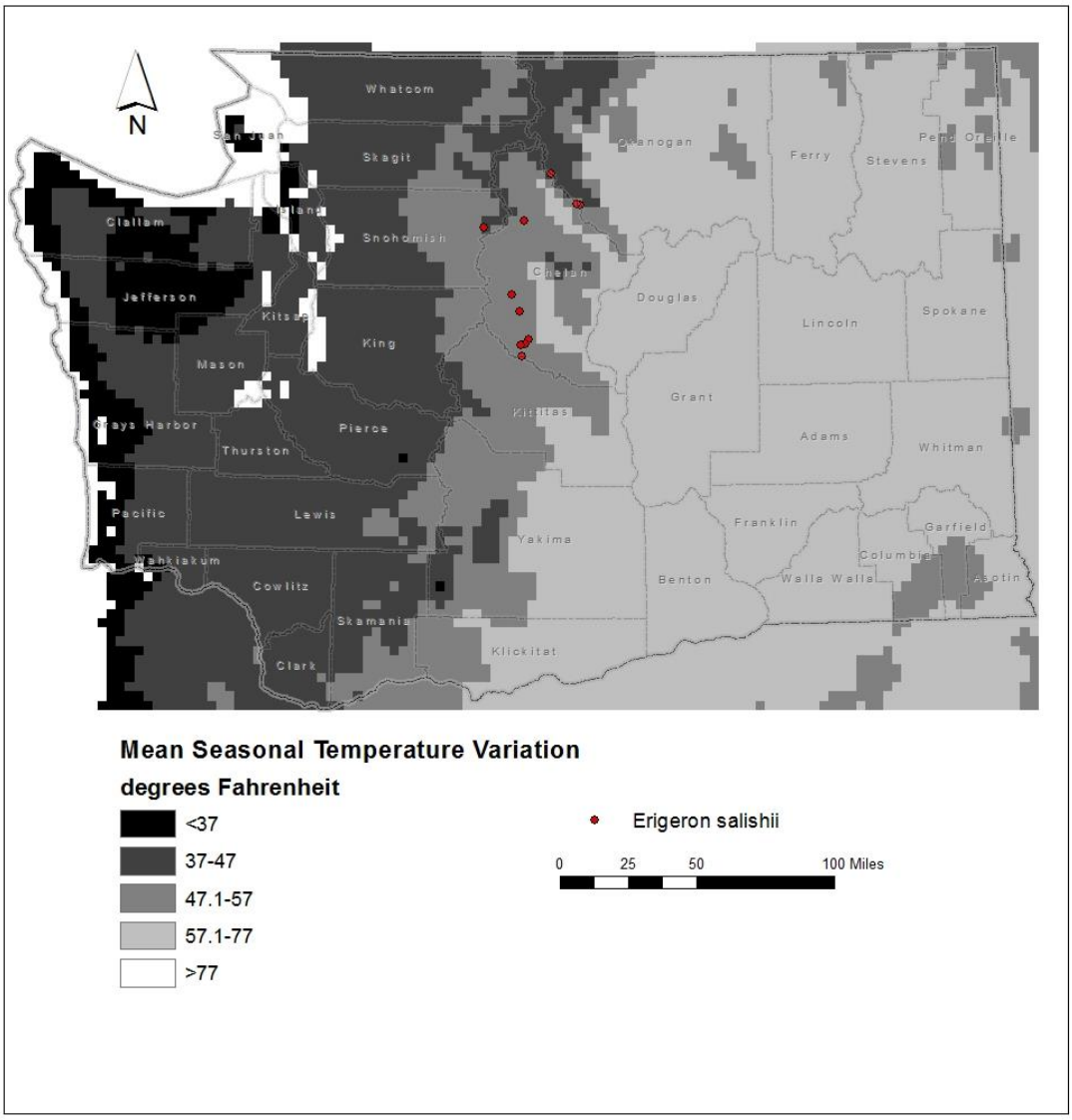

Figure 3. Historical thermal niche (exposure to past temperature variations) of *Erigeron salishii* occurrences in Washington. Base map layers from www.natureserve.org/ccvi

C2bi. Historical hydrological niche: Neutral.
All of the known populations of *Erigeron salishii* in Washington are found in areas that have experienced average or greater than average precipitation variation in the past 50 years (>20 inches/508 mm) (Figure 4). According to Young et al. (2016), these occurrences are neutral for climate change.

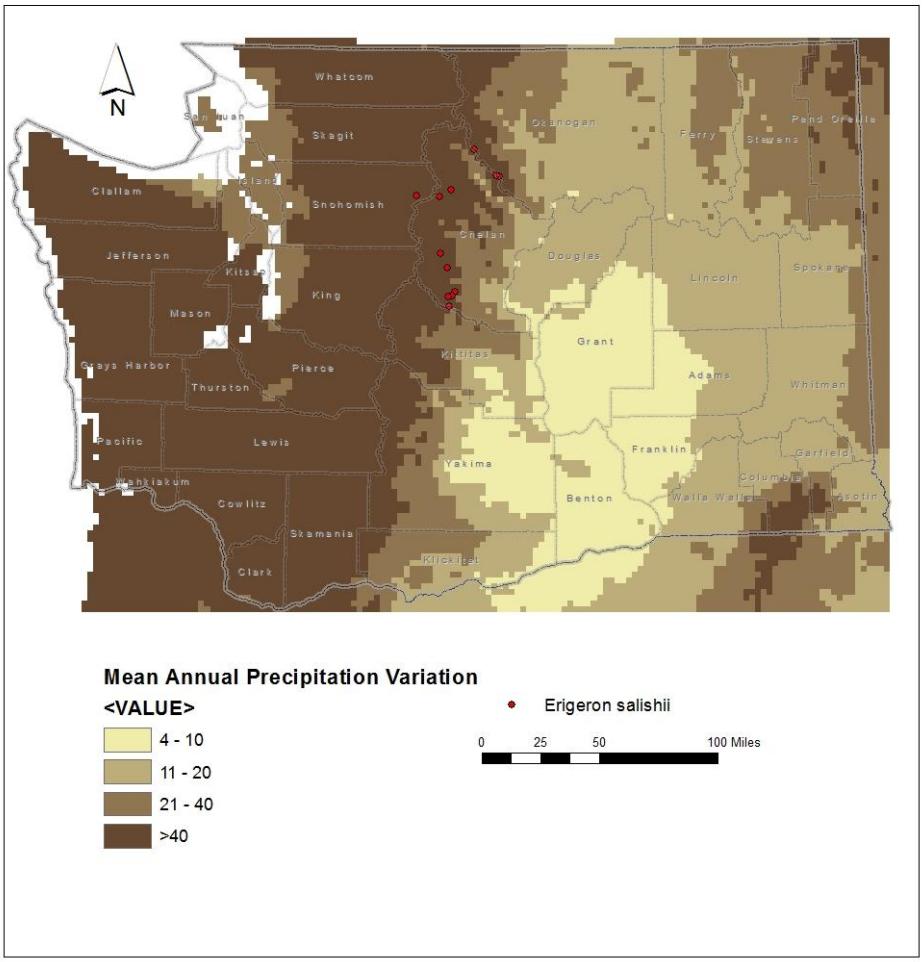

Figure 4. Historical hydrological niche (exposure to past variations in precipitation) of *Erigeron salishii* occurrences in Washington. Base map layers from www.natureserve.org/ccvi

C2bii. Physiological hydrological niche: Neutral.
This species is not dependent on a strongly seasonal hydrologic regime or specific wetland habitats (but see "Dependence on ice or snow-cover habitats" below).

C2c. Dependence on a specific disturbance regime: Neutral.
Erigeron salishii occurs in alpine talus, scree, and tundra habitats that are subject to high winds. Other than occasional rock fall, these are largely undisturbed sites at present. Under future climate change scenarios, these sites could become invaded by tree or shrub species or lower elevation forbs and grasses, resulting in increased soil accumulation, more litter, and enhanced probability of fire (Rocchio and Ramm-Granberg 2017).

C2d. Dependence on ice or snow-cover habitats: Somewhat Increase.
The populations of *Erigeron salishii* in Washington are found on alpine ridgecrests and talus slopes/tundra associated with winter snow accumulation, though the areas may be free of snow due to evaporation or wind during the growing season. Reduced snowpack due to climate change would decrease the amount of moisture available through runoff (Rocchio and Ramm-Granberg 2017)

C3. Restricted to uncommon landscape/geological features: Neutral.
Erigeron salishii is found primarily on outcrops of felsic tonalite, a rock type similar to granite diorite that is exposed at high elevations in the East Cascades and Okanogan mountains.

C4a. Dependence on other species to generate required habitat: Neutral
The alpine talus and tundra habitat occupied by *Erigeron salishii* is maintained largely by natural abiotic conditions.

C4b. Dietary versatility: Not applicable for plants

C4c. Pollinator versatility: Neutral.
Erigeron salishii, like most composites, is pollinated by generalist insect pollinators.

C4d. Dependence on other species for propagule dispersal: Neutral.
Fruits have a feathery pappus and are readily wind-dispersed, and thus are not dependent on animal species for transport.

C4e. Sensitivity to pathogens or natural enemies: Neutral.
Not known, but probably not a limiting factor.

C4f. Sensitivity to competition from native or non-native species: Somewhat Increase.
Under present conditions, competition from non-native species is minor, as few introduced plants are adapted to the harsh environmental conditions of the alpine zone. Vegetation cover is low in rocky talus slopes and fell-fields due to the paucity of germination sites and periodic rock fall. Under projected climate change, competition could increase if lower elevation plant species are able to expand their range into formerly uninhabitable habitat (Rocchio and Ramm-Granberg 2017).

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

C5a. Measured genetic variation: Unknown.
Not known. Douglas and Packer (1988) report that *Erigeron salishii* is a diploid (2n = 18), while its close relative, *Erigeron compositus* is a polyploid (2n = 54).

C5b. Genetic bottlenecks: Unknown.
Not known.

C5c. Reproductive System: Neutral.
Erigeron salishii appears to be an obligate outcrosser and is not limited by pollinators or dispersal, so is presumed to have average genetic variation, though no research has been done to confirm this.

C6. Phenological response to changing seasonal and precipitation dynamics: Neutral.
Based on herbarium records in the Consortium of Pacific Northwest Herbaria website (pnwherbaria.org), *Erigeron salishii* has not changed its typical blooming time since the 1920s.

Section D: Documented or Modeled Response to Climate Change

D1. Documented response to recent climate change: Neutral.
No major changes have been detected in the distribution of *Erigeron salishii* in Washington since it was first discovered in the state in the 1920s.

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.

Douglas, G.W. and J.G. Packer. 1988. *Erigeron salishii*, a new *Erigeron* (Asteraceae) from British Columbia and Washington. Canadian Journal of Botany 66(3): 414-416.

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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